

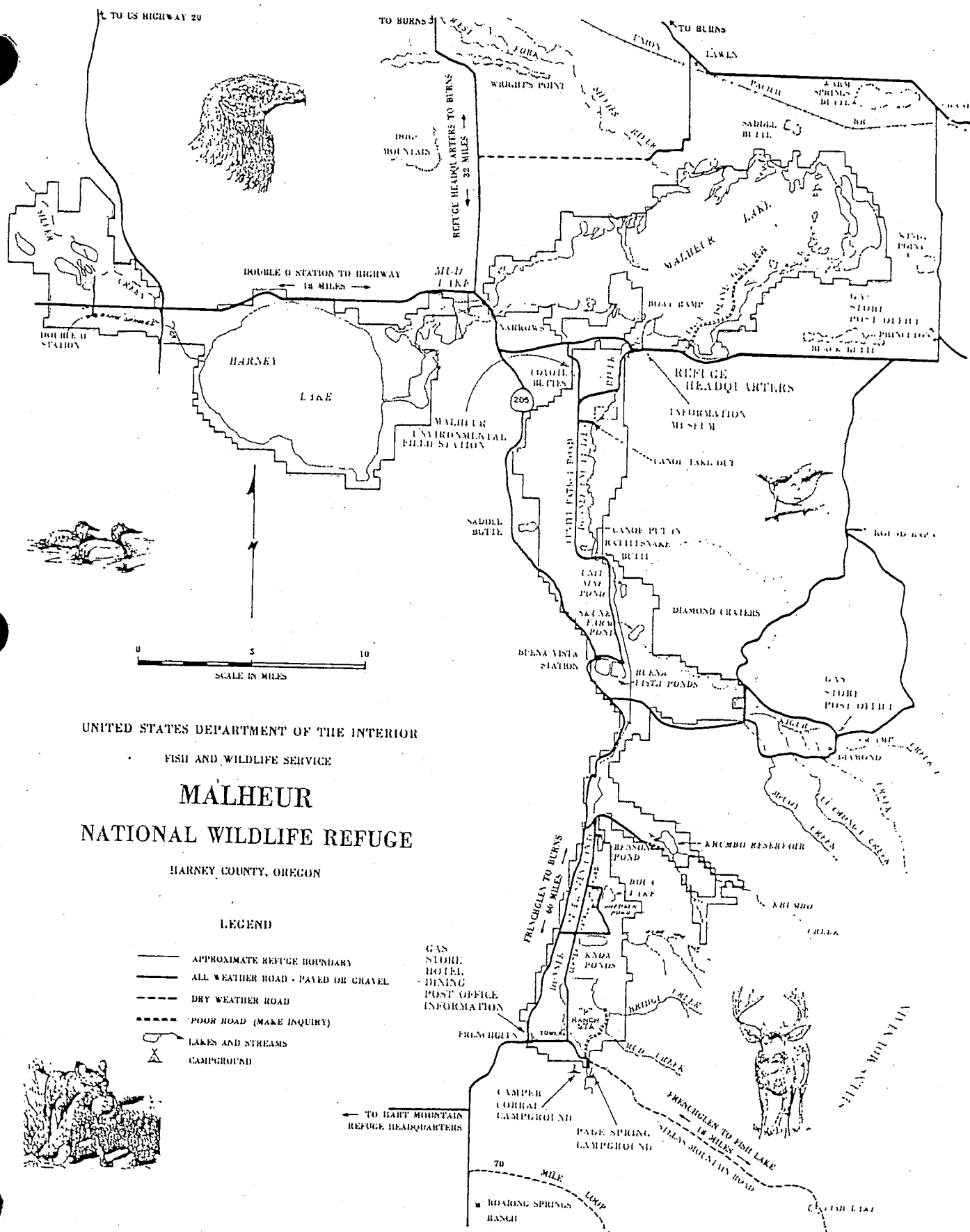
MALHEUR NATIONAL WILDLIFE REFUGE
Princeton, Oregon

ANNUAL NARRATIVE REPORT
Calendar Year 1991

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UNITED STATES DEPARTMENT OF THE INTERIOR
 FISH AND WILDLIFE SERVICE
MALHEUR
 NATIONAL WILDLIFE REFUGE
 HARNEY COUNTY, OREGON

LEGEND

- APPROXIMATE REFUGE BOUNDARY
- ALL WEATHER ROAD - PAVED OR GRAVEL
- - - DRY WEATHER ROAD
- - - POOR ROAD (MAKE INQUIRY)
- LAKES AND STREAMS
- CAMPGROUND



INTRODUCTION

General

Malheur National Wildlife Refuge (Malheur Refuge) is located in the Great Basin Region of southeastern Oregon. Shaped like a lopsided "T", the refuge spans an area 40 air miles long and 39 miles wide. Containing 185,540 acres, it is one of the largest of the over 475 units within the National Wildlife Refuge System. Refuge headquarters, on the south side of Malheur Lake, is 32 miles southeast of Burns--the nearest town. Elevation at headquarters is 4,100 feet above sea level.

The refuge was established by Executive Order of President Theodore Roosevelt in 1908 as a 81,786 acre "preserve and breeding ground for native birds" and was called the Lake Malheur Reservation. The 64,717 acre Blitzen Valley portion of the refuge was acquired in 1935 from the Eastern Oregon Land and Livestock Company under an Executive Order signed by President Franklin D. Roosevelt. The order specified that the lands were for use "as a refuge and breeding ground for migratory birds and other wildlife". The reservation was renamed the Malheur Migratory Bird Refuge. In 1940 the name was officially changed to Malheur National Wildlife Refuge. The last large segment, 14,751 acres in the Double-O Unit, was purchased from the William Hanley Company in 1941.

The refuge's basic habitat types are summarized in Table I, below.

Table I. Habitat types and acreages on Malheur Refuge.

Grass/Shrub Uplands.....	63,380
Marshes.....	60,310
Alkali Dry Lake Beds.....	32,170
Meadows.....	25,600
Croplands.....	2,500
Riparian.....	800
Admin. sites/roads.....	780
	<hr/> 185,540

Regional Setting

Since prehistoric time, the Malheur-Harney Lake Basin has been an important nesting and migration area for migratory birds--especially waterfowl, raptors, and marsh birds. Together, the refuge and the Silvies River floodplain are one of the most important migration and production areas in the Pacific Flyway.

Major Pacific Flyway concentrations of snow and Ross' geese, northern pintails, bald eagles, long-billed curlews and other shorebirds, and lesser sandhill cranes occur in the basin during the spring migration. Concentrations of lesser sandhill cranes occur mainly on the Silvies River floodplain.

Early spring waterfowl use is concentrated on the open water areas of Double-O, Harney Lake, east Malheur Lake, and the Silvies River floodplain. As more open water becomes available, the birds disperse to all suitable habitat within the basin. During a study conducted from 1975-78, 54 percent of the spring waterfowl use occurred on the privately owned floodplain and 46 percent on the refuge.

The fall migration routes are similar to spring routes. The major exception is lesser sandhill cranes. They shift their route to the west, passing on the west edge of the basin, then head southwest between Iron and Wagontire Mountains. A lack of water on the Silvies River floodplain during this period causes waterfowl use to shift dramatically to the refuge. While the recent flood cycle has reduced the attractiveness of Malheur Lake for waterfowl, the refuge still serves as a major Pacific Flyway stopover for tundra swans, ducks and geese (especially redheads, canvasbacks, and Canada geese), shorebirds, and colonial nesting birds.

Prior to the flooding of the 1980's, Malheur Lake was used by 15 to 35 percent of the Pacific Flyway's canvasback population. Of the birds that winter in San Francisco Bay, over 35 percent have been seen on Malheur Lake at one time. As the Malheur Lake marsh was degraded by flood waters and high carp populations, canvasback use declined.

Malheur Refuge is a major production area in the Pacific Flyway. Before the flood, Malheur Lake was a shallow, freshwater marsh, the largest in western North America. This marsh was especially important to diving ducks (redheads, canvasbacks, and ruddy ducks), colonial nesters (eared and western grebes, white pelicans, double-crested cormorants, great blue herons, great egrets, snowy egrets, black-crowned night-herons and white-faced ibis), and associated marsh and shorebirds. Since the flood, Malheur Lake has become an open-water lake habitat supporting fewer species (primarily fish eating birds and Canada geese).

Concentrations of waterfowl and waterbirds also attract bald eagles and peregrine falcons to the area during migration.

The refuge plays an important role in production of many bird species such as golden eagles, northern harriers, white pelicans, snowy plovers, American avocets, killdeer, greater sandhill cranes, American coots, cliff swallows, long-billed curlews, white-faced ibises, Franklin's gulls, bobolinks, logger-head shrikes, common yellow-throats, yellow warblers, willow flycatchers and Brewer's sparrows.

Impacts of the Great 1980's Flooding

Record snowfall and unusually cool summers, from 1980 through 1986, resulted in record flows down the Silvies River, Blitzen River, and Silver Creek drainages. This caused significant damage to water management facilities in the Blitzen and Double-O units and raised the level of the Malheur-Mud-Harney Lakes system to record levels. In July 1985, the lake reached 4102.68 MSL. The once-famous Malheur Marsh was converted to open water. A flood restoration package has been completed which outlines \$11.4 million of rehabilitation to be completed.

Concurrent with the rising lake levels, populations of carp exploded in Malheur Lake, greatly diminishing the quality of the marsh for waterfowl. Waterfowl use and production on the lakes has drastically declined. The only waterfowl species which has fared well on the lakes since the flood is the Canada goose. It has adapted to nest on the newly formed islands. Some islands support over 50 goose nests and the birds are almost "colonial".

The impacts of flooding on wildlife fall into three basic categories. First, the species that depend on a large amount of marsh nesting habitat (swans, rails and marsh birds), meadows (greater sandhill cranes) or alkali playa (snowy plover) were greatly impacted and the number of these species nesting in the lake units dropped to nil. Second, the colonial-nesting birds proved very adaptable. Their numbers skyrocketed. White pelicans found the small isolated islands and in 1985 began nesting on the refuge. By 1988, over 900 pelicans were being produced annually. Egrets, herons and ibis relocated on and off the refuge in smaller, scattered colonies and their numbers also increased (see the Annual Narrative Reports 1985-87). Third, our ability to provide good habitat conditions for key species in the Blitzen Valley and Double-O units was affected by flood damage to the water management systems.

The lakes began to decline in 1986, providing extensive mudflat habitats around their perimeters. Sparse vegetation, consisting primarily of annual forbes, has shown up on the drying flats. Emergent vegetation is still sparse, although cattails, burreed and hardstem bulrush have begun to grow at the mouth of the Blitzen River and 200 acres of alkali bulrush can be found east

of Cole Island Dike. Even with the sparse, new growth of emergents the lakes remain generally unproductive for waterfowl except geese. A sand ridge closed the channel between Mud and Harney Lakes in 1988, separating the two systems' surface connection. Harney Lake has a sandy substrate allowing its water to clear, while Malheur and Mud Lake waters remain turbid. As the lakes have receded, Harney Lake has become increasingly saline, making it inhospitable for carp. The fresher water of Malheur Lake continues to support a high carp population. In 1991, water receded to it's lowest level causing the channel, locally known as The Narrows, connecting Mud and Malheur Lakes to dry up, completing the demise of the large lake formed by the flood waters of the 1980's.

INTRODUCTION

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A. HIGHLIGHTS

Drought conditions continued, however, precipitation was up from 1990 (Section C).

During the month of September Malheur Lake became isolated from Mud Lake at the Narrows (Section C).

The Oregon High Desert Discovery, an interagency interpretive plan, is set in motion. Public meetings are held in fourteen locations statewide (Section D3).

Twenty-one sandhill crane colts were equipped with transmitters as part of a radio-telemetry study. The study is aimed at determining the causes of crane colt mortality while predator control management is in effect (Section D5).

Archaeological and geomorphic investigations begin at two prehistoric sites on Malheur Lake (Section D5).

Osteological analyses of the remains of over fifty individuals recovered from flooded archaeological sites begins (Section D5).

Refuge fire crew is stationed for the first time at Frenchglen. The refuge fire crew rotated into the BLM fire crews duty schedule (Section F9).

In July, on-site water rights review marked the kickoff of a much higher profile in documenting, clarifying, recording and defending our complex water right picture. Approval was granted to recruit a GS-11 assistant manager to work exclusively on the project (Section F11).

Five Partners for Wildlife wetlands restoration projects are completed (Section F15).

Three brood ponds (Stubblefield, North Swamp, and Center Sage) are constructed in the Blitzen Valley and a fourth at Mud Creek is begun. Water is supplied to the Windmill Pond brood pond (Section I1).

Trumpeter swans are transplanted from Red Rock Lakes refuge to Malheur and two non-breeders are transplanted from Malheur Refuge to the Summer Lake Wildlife Area (Section J1).

B. CLIMATIC CONDITIONS

The drought continued from 1990. Snowpack on the Steens Mountains was only 35% of normal at the end of February. March through May brought cooler than normal temperatures and much needed precipitation. The moisture aided spring green up which produced lush growth in refuge uplands, meadows, and marshes. A hot, dry July and August cured grasses and other fine fuels. We expected a rash of wildfires due to the high fuel loading. Fortunately precipitation and high humidities accompanied the late summer thunderstorms which reduced the number, size, and intensity of lightning fires.

Table II Monthly High and Low Temperatures, Precipitation, and Malheur Lake Levels Recorded at Malheur Refuge Headquarters, 1991.

	<u>TEMPERATURE (HQ) F</u>				<u>PRECIPITATION</u>		<u>MALHEUR</u>
	<u>HIGH</u>		<u>LOW</u>		<u>INCHES</u>		<u>LAKE</u>
	1990	1991	1990	1991	1990	1991	<u>ELEVATION</u>
January	55	52	9	-1	0.12	0.38	4093.87 MSL
February	59	66	4	14	0.305	0.44	4093.87 MSL
March	70	63	12	12	0.22	0.75	4093.58 MSL
April	72	68	20	13	0.47	1.07	4093.15 MSL
May	85	75	21	25	1.36	3.75	4093.70 MSL
June	94	84	30	32	0.18	0.90	4093.65 MSL
July	96	93	41	40	0.17	0.34	4093.02 MSL
August	96	91	39	41	0.59	0.01	4092.40 MSL
September	88	88	36	28	0.00	0.08	4091.30 MSL
October	81	83	16	6	0.66	0.85	4091.08 MSL
November	65	54	14	9	0.69	0.87	4091.04 MSL
December	53	49	-22	9	0.05	0.36	4091.00 MSL
TOTAL					4.815"	9.8"	-2.87 ft

Although annual precipitation figures almost doubled from 1990, drought conditions again prevailed. Total annual precipitation at refuge headquarters measured 9.78 compared to 4.81 in 1990. According to the Soil Conservation Service snowpack runoff was at 52 percent of normal in early March but increased to 102 percent by the end of May. Precipitation for the month of May totaled 3.73" breaking the old 55 year of 3.00" in 1981. The remainder of the year was very similar to 1990 - dry. Temperatures were mild compared to 1990 with a low of -1° recorded in January and a high of 93° recorded in July.

Malheur Lake continued to recede, dropping a total of 2.87 feet during the year. This equates to a loss of 35,900 water surface acres. The highest lake level recorded at the narrows was 4093.87 feet on February 25 and the lowest level was 4091.00 on December 5, 1991. During the month of September Malheur Lake became isolated from Mud Lake at The Narrows. After that time Malheur Lake elevations are only estimates, as the water staff gauge was only located at The Narrows.

Table III Annual Peak and Low Elevations of Malheur Lake, 1982 - 1991.

Year	Peak/Low	Date	Elevation
1982	PEAK	JUNE 01	4095.85 MSL
	LOW	OCT 25	4093.47 MSL
1983	PEAK	JUNE 30	4098.80 MSL
	LOW	NOV 01	4097.80 MSL
1984	PEAK	JUNE 25	4102.42 MSL
	LOW	OCT 09	4101.38 MSL
1985	PEAK	APR 23	4102.68 MSL*
	LOW	OCT 31	4100.62 MSL
1986	PEAK	MAY 11	4102.56 MSL
	LOW	NOV 12	4100.54 MSL
1987	PEAK	MAR 17	4100.92 MSL
	LOW	NOV 09	4098.56 MSL
1988	PEAK	MAR 08	4099.06 MSL
	LOW	NOV 18	4097.28 MSL
1989	PEAK	MAY 14	4098.90 MSL
	LOW	NOV 13	4096.30 MSL
1990	PEAK	MAR 27	4096.62 MSL
	LOW	UNKNOWN	4094.00 MSL
1991	PEAK	FEB 25	4093.87 MSL
	LOW	DEC 05	4091.00 MSL**
*Peak flood level			
**Estimate--gauge out of water			

C. LAND ACQUISITION

1. Fee Title

A landowner contact was made by Don Gerig (Realty) regarding purchase of a 320 acre inholding called the Emerson tract. It is owned by Conevari Timber Company of Fortuna, California. The owner was surprised by our interest and had not previously considered selling. They also have landholdings in the Crane area, east of the refuge, and asked if the Service was interested in buying it all. Negotiations stumbled when Don Gerig transferred, but by year end the case had been assigned to Tom Menabe.

4. Farmers Home Administration Conservation Easements

In 1991, one Conservation Easement (Wilburn Williams Inventory) was assigned to Malheur Refuge. The easement contains a narrow riparian corridor on the north shore of the Middle Fork of the John Day River, near Kimberley, Oregon. Biologist Ivey performed a site inspection, a contaminant survey, and visited with the new landowners of the easement property in April. The easement will be called the Gary & Sharon Shultz Easement, after the current landowners.



In an effort to control his neighbor's trespass cattle (shown above) and to improve his own riparian habitat, the owner, Charles DeGuire, of a 113 acre parcel contacted the refuge and signed a 25 year Farm Bill lease to eliminate livestock grazing. In exchange the refuge fenced his property and agreed to construct a water impoundment. Thanks to his interest in wildlife habitat the improvement in riparian habitat should be dramatic. RV 11/91

D. PLANNING

2. Management Plan

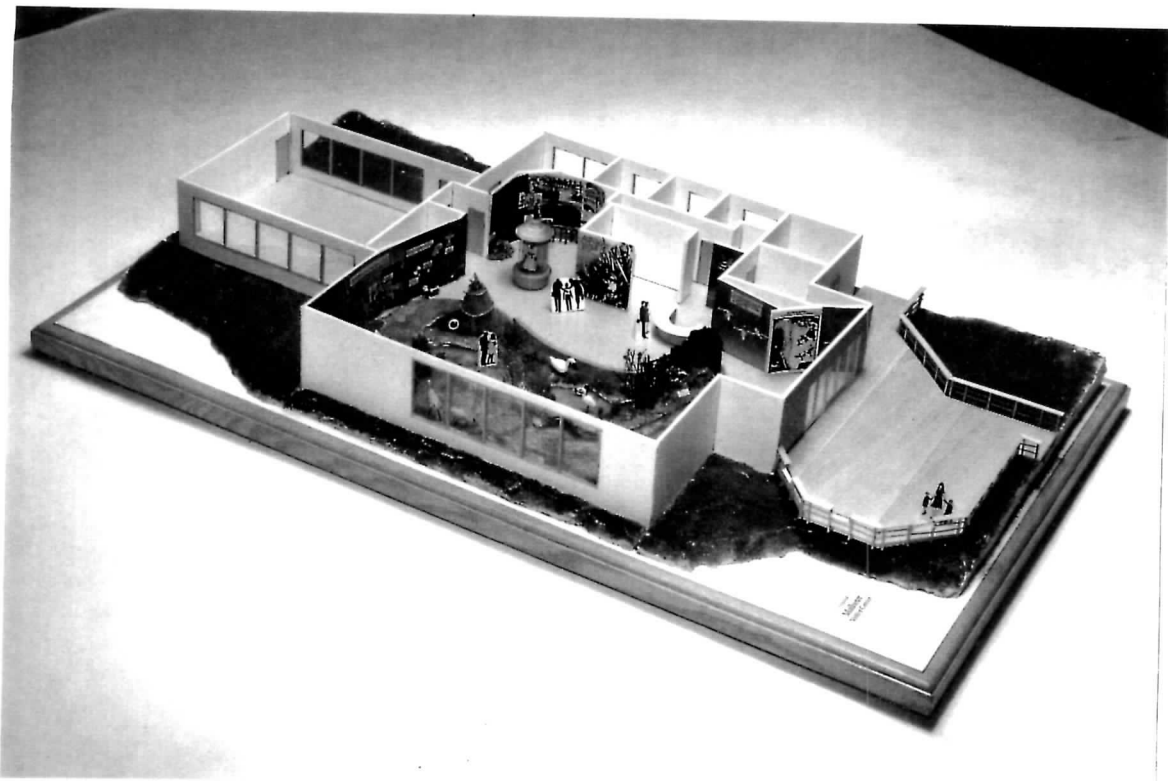
The Blitzen Valley Management Plan continued to be used as the main guideline in implementing haying and grazing actions during the 1991/92 grazing season. While the plan was approved in November of 1990, the technical appendices including individual field prescriptions were not completed until November of 1991. One other appendix, a biological unit plan detailing current habitat conditions, water management system deficiencies and other maintenance needs is not yet completed.

A Habitat Monitoring and Inventory Plan was submitted for review to the Regional Office in May 1991. In November the plan was returned with several editing suggestions. At the end of December, the plan was being prepared for final review and approval.

3. Public Participation

The Oregon High Desert Discovery interagency interpretive plan was the subject of many public meetings during 1991. The Bureau of Land Management (BLM) and the Service held a total of fourteen meetings in the following locations: Burns, Diamond, Frenchglen, Fields, Drewsey, Portland, Medford and Bend. Conceptual plans for the project were based on existing documents for these five geographically linked areas: Malheur Refuge, Steens Mountain Recreation Lands, Diamond Craters Outstanding Natural Area, Hart Mountain National Antelope Refuge, and Warner Wetlands Area of Critical Environmental Concern. Public input and support helped shape this plan which is committed to providing the best possible services for visitors, while maintaining the integrity of the resources.

In response to the public participation received a slide show was developed, model visitor-information centers were constructed and an Oregon High Desert Discovery brochure is in the works. Under the direction of Dick Kuehner, Jean Harrison and the other people in the regional Division of Education, Publications, Interpretation, and Cultural Resources (EPIC) this project moves forward into 1992.



Model of proposed Malheur Refuge Interpretive Center. JH 2/92

4. Compliance with Environmental and Cultural Resource Mandates

Cultural resource surveys were conducted by the refuge archaeologists for a number of refuge projects: Five Mile Corral, Stubblefield Brood Pond, Diamond Lane Corral, Playa Pond, new headquarters shop, Buena Vista Boundary Fence and the Mud Creek Fish Pond. Archaeological sites were found in the vicinity of almost all of the project areas, but it was determined that most of the proposed projects would not adversely impact any of the sites and the projects commenced. In those instances where sites would be adversely impacted (Diamond Lane Corral and Playa Pond) the project locations were moved or modified to avoid impacts to the sites.

5. Research and Investigations

Malheur NR 81 "Color Marking of Greater Sandhill Cranes on Malheur Refuge, Oregon" - MLH-30.

The objectives and justification for this study include color marking greater sandhill cranes which nest and stage at Malheur Refuge, to document effects of land use practices on cranes breeding at Malheur, and to identify birds from other flocks which stage at Malheur Refuge during spring and fall migration. In 1991, seven cranes were captured and banded

with plastic tarsal bands. To date, over 360 cranes have been marked, providing valuable long-term data on crane ecology.

Malheur NR 86 "Study of Population Trends of Small Mammals on Malheur Refuge, Oregon" - MLH-33.

This study was initiated in 1986 by Dr. David Kerley of Eastern Oregon State College at La Grande. The purpose is to monitor long-term trends in small mammal populations in Great Basin sagebrush and greasewood shrub communities.

Dr Kerley provided the following summary of his 1991 findings:

"All populations on both grids showed a decline from the 1990 trapping season. The Perognathus parvus numbers should be at their highest in July because of the recruitment of new young into the population. This has certainly been true in the past on these two grids. If it is true this year, the Perognathus parvus population on both grids showed a significant decline. This was also true of the Dipodomys population on the sagebrush grid. There also seems to be a marked decline in Reithrodontomys population on the greasewood grid."

Malheur NR 85 - "Effect of Early Spring Burning on Greater Sandhill Cranes (*Grus Canadensis tabida*) at Malheur Refuge, Oregon" - MLH-34.

This study was initiated in 1985 by C.D. Littlefield. The primary objective is to determine how prescribed burning affects the overall nesting biology of sandhill cranes. The study is a long-term monitoring effort aimed at elevating prescribed burning as a possible tool to help the refuge reach sandhill crane production objectives. Data collection continues and no results or conclusions are available at this time.

Malheur NR 86 - "Response of *Salix exigua* to Prescribed Burning" - MLH-35.

This study was initiated in 1986 by Dr. Fritz Knopf, of the Service's National Ecology Research Center, Ft. Collins, Colorado. The objectives and justification are outlined in the 1986 Narrative Report. Field data recording was completed in 1990 and final results are pending. Tentatively, fire does not appear to stimulate willow regeneration or growth at Malheur Refuge.

Malheur NR-87 - "Environmental Contaminants and Reproductive Success of Waterfowl, Stilts, and Coots at Malheur Refuge". - MLH-38.

This study was initiated by Dr. Charles Henny, of Patuxent

Wildlife Research Center, Pacific Northwest Field Station, to investigate levels of contaminants in eggs of selected wetland species, and to determine if contaminants were impacting production in these species.

Final results are not yet available, however, there are some interesting preliminary results. Based on a very small sample, canvasback eggs contained concentrations of selenium that were generally double selenium concentrations found in other duck species' eggs. However, levels of selenium found in all eggs from Malheur Refuge, including canvasbacks, were low and not considered to be a threat to these species.

Malheur NR 88 - "Effects of Land Use on Duck Pair Use at Malheur Refuge", - MLH-40.

Wildlife Biologist, Gary Ivey initiated this study in 1988 to measure duck pair use on paired plots under different land use regimes. Preliminary results indicate that duck pairs select the most intensively treated areas (e.g. burned, heavy grazing) early in the breeding season and apparently shift to areas of less intense treatments later.

Malheur NR 88 - "Willow Flycatcher Reproductive Success, Population Dynamics, and Habitat Relationships". MLH-41.

Jim Sedgwick of the National Ecology Research Center initiated this study in 1988. The study is designed to examine the extent and causes of variation in reproductive success, and the survival, productivity, and habitat relationships of a healthy population of willow flycatchers at Malheur Refuge. Site tenacity, as related to reproductive success and habitat quality, predation, parasitism by brown-headed cowbirds, and environmental (habitat) correlates of reproductive success will receive special attention. This year was the fourth year of data collection.

Results of willow flycatcher banding on three study areas in 1991 included 148 recaptures from previous years, yielding a return rate of about 52 percent. Additionally, 139 new adult birds and 145 nestlings were banded on the study areas, with another 150 birds banded from outside the study areas. Nest success was 34.8 percent, from a sample of 187 nests. Cowbird parasitism was a major cause of nest failure, as cowbirds parasitized 35.8 percent of all nests. In spite of this, only 14 cowbirds fledged, or 0.12 per pair.

Malheur NR-91 - "A Radio-Telemetry Study to Identify Sandhill Crane Colt Mortality Factors. - MLH-42.

In 1991, a radio-telemetry study was initiated by Biologist Gary Ivey to determine causes of crane colt mortality while

the predator control management is in effect. This study is planned to be continued in 1992 and 1993, and will provide data necessary for better management decisions in the future regarding production of sandhill cranes on the refuge.

During the study, 21 sandhill crane colts were equipped with transmitters. Of these, contact was lost with one, six lost their transmitters, two appeared to have drowned, one died from apparent complications at the incision, nine were predated, and one fledged.

The most surprising finding in this study was the amount of mink predation on the colts (five out of fifteen). Mink did not appear to be a factor in a previous telemetry study conducted by C.D. Littlefield in 1983 and 1984. Mink are not included in our predator management program.

Based on a sample of 15 colts, the study data suggested a mortality rate of 93.3 percent (14/15). Of 76 crane nests monitored, nesting success for the refuge was 50 percent. Of the 214 pairs breeding on the refuge, an estimated 107 nests hatched. Using an average clutch size of 1.92, an estimated 205 colts hatched. A total of 15 crane colts was produced on the refuge in 1991. This yields a mortality rate of 92.6 percent (190/205) which compares favorably with the telemetry data.



Sally Flatland and Kathy Brown attaching a radio transmitter to a larger crane colt. GI 8/91

Malheur NR-91 -"Controlling Emergent Marsh Vegetation with Haystacks".-MLH-43

This study was initiated by Biologist Gary Ivey to evaluate the feasibility of using stacked hay to control emergent vegetation in refuge marshes. In January 1990, two sets of plots were established, each with a control half and an experimental half. Before the study, baseline data were collected on the plots, including plant species composition and stem densities. Emergent vegetation was mowed and raked into stacks on the experimental areas. Results are not available yet and will be reported in 1992.

Malheur NR-91 -"Reestablishment of Vegetation at Malheur Lake Following Extensive Flooding." - MLH-44

Sherry Spencer, a graduate student from Portland State University initiated this study for her Master's Thesis to document plant succession on Malheur Lake's mudflats following the loss of all terrestrial plants during the high water levels of the mid 1980's. The high water levels had drowned out all emergent marsh vegetation in the lake. This was the pilot year of the study, and Ms. Spencer documented species occurrence, percent cover and frequency of occurrence of 52 plant species along three transects.

Malheur NR 91 "Archaeological and Geomorphic Investigations of Prehistoric Sites on Malheur Lake" - MLH-45

The first phase of an archaeological services contract started in October. This year's work was oriented toward the relationship of archaeological sites and the geomorphic processes that have shaped the landforms on Malheur, Mud and Harney Lakes. Intermountain Research of Silver City, Nevada arrived in October to begin work at three archaeological sites that were flooded in the 1980's. Backhoe trenches were cut through two sites and on the edge of a third. The goal of this trenching was to determine the depth of cultural material at the site, as well as to reveal information about the structure of the landform on which the sites are located. Small excavation units were placed adjacent to the trenches, in areas with concentrated artifacts and cultural material, to recover dateable artifacts and organic material.



Bob Elston of Intermountain Research screens soil from an excavation unit. CB 10/91



Soil scientist from Intermountain Research describes stratigraphy of soil in trench while an archaeologist excavates a test unit. CB 10/91

Recovery of artifacts from excavation units was less than expected. It appears that deposits containing cultural material in the flood zone of the 1980's floods were almost completely obliterated. Artifacts and other material that were once contained in these deposits were mixed together and left lying on the surface of the shoreline. Portions of the site that were not flooded revealed a lot of information. Stratigraphic layers at the sites show fluctuations of the shoreline and episodes of flooding comparable to the flooding in the 1980's. Deposits found near the bottom of trenches contained volcanic ash deposited in deep water, because the chemical composition of volcanic ash is specific to a single eruptive event this period of deep water can be dated fairly accurately and establishes a baseline date for the soil at the site. Gravel deposits containing fish bone were also recovered from one trench. These bones can be used to date the gravel deposit and can provide biological information about what fish were present in the lake when the gravel was being deposited. The wealth of data recovered from these sites will provide information not only about the prehistoric human inhabitants of the marsh, but will tell us a lot about environmental and biological changes that have occurred through time.



Members of the Burns Paiute Tribe watch as artifacts and animal bones are recovered from screens during excavations at an archaeological site. CB 10/91

Malheur NR 91 "Osteological Analyses of Human Remains from
Flooded Sites on Malheur Lake" - MLH-46

Analyses of human skeletal remains was begun in 1991 as a condition of a Memorandum of Understanding between the Service, the Burns Paiute Tribe and the State Historic Preservation Office. All human remains recovered from flooded archaeological sites on Malheur Lake must be analyzed prior to reinterment. Brian Hemphill a physical anthropologist with Heritage Research Associates, Eugene, Oregon is conducting these analyses. The analyses include descriptions of pathological and traumatic occurrences; determinations of sex, age at death, and stature; x-rays of long bones for evidence of malnutrition, internal evidence of diseases and trauma; and CAT scan images to measure biomechanical stress. Human remains recovered from 1988 through 1990 have undergone all analyses with the exception the CAT scans. Skeletal material recovered during the summer of 1991 will undergo all analyses in 1992.

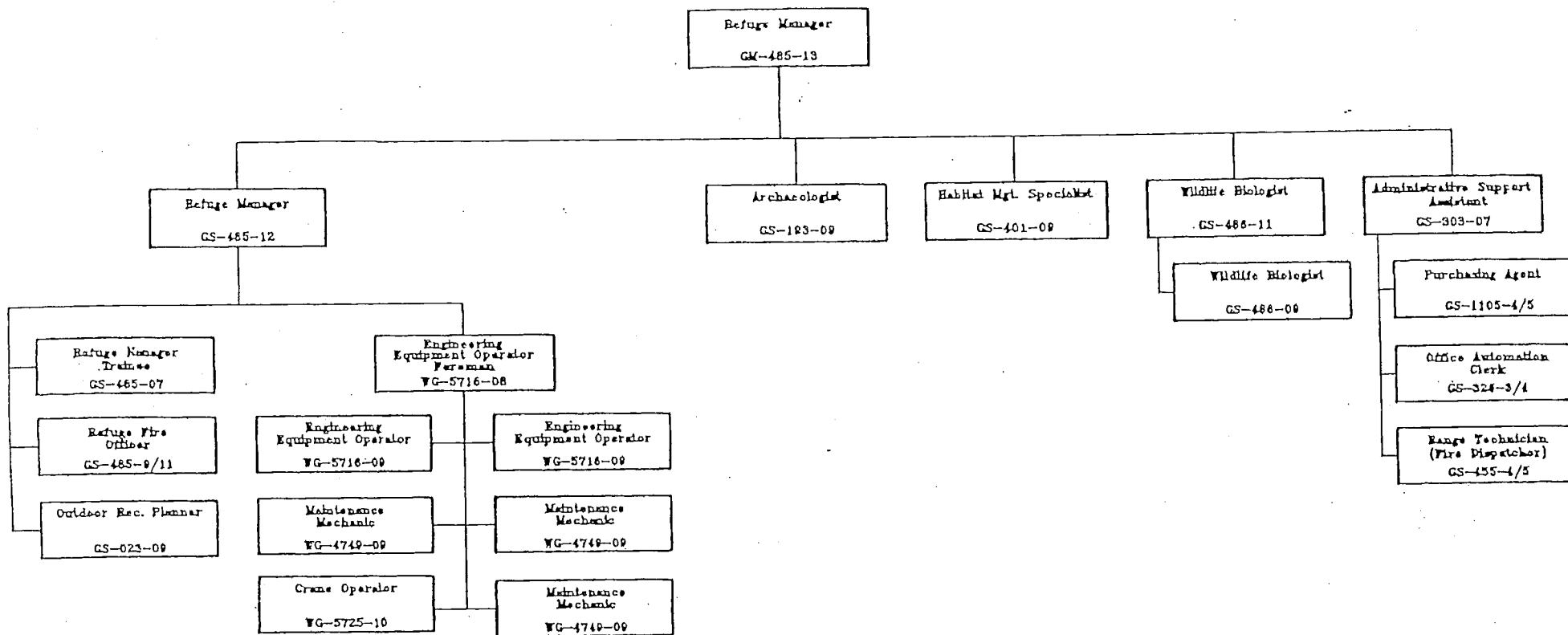
Age at death for over fifty individuals ranges from newborn to 60 years old. The oldest individual is an elderly female who suffered from severe arthritis and osteoporosis. Her health had deteriorated to the point that she probably received care for an extensive period of time prior to her death. Other individuals show minor and advanced arthritis in their wrists and elbows. Arthritis in these joints are indicative of occupational stress resulting in arthritis. Arthritis also occurs in the lower back on most of the adults. This is fairly common in most prehistoric populations and is not related to occupational stress. Traumatic injuries have been noted on several individuals. These injuries include shoulder dislocations, cuts on clavicles and ribs that were probably caused by stabbing, broken bones and head injuries. Most of these injuries did not result in the death of the individual.

Radiocarbon dates were obtained for ten intact burials. The oldest date is 60 A.D. Most of the dates cluster between 1430 and 1700 A.D. and the most recent date is 1840 A.D. The high occurrence of deaths in the 1500 and 1600's may be the result of European introduced infectious diseases (measles and smallpox) that spread from Spanish explorers in California to tribes living along the Columbia River and then into the intermountain region. These infectious diseases may have been the cause of death for many of the children recovered from sites on Malheur Lake. Most of the children were only 5-6 years old at death and studies of other prehistoric populations indicate that it is uncommon for children to survive infancy and then die soon after.

E. ADMINISTRATION

1. Personnel

1. Forrest W. Cameron, GM-13, PFT.....Refuge Manager
2. Dan Walsworth, GS-12, PFT (EOD 4/91)....Primary Asst. Manager
3. Richard W. Voss, GS-12, PFT.....Primary Asst. Manager
(Transferred to Kilauea Point NWR, 1/91)
4. Joel David, GS-11, PFT (EOD 7/91).....Asst. Mgr., Habitat
5. Michael I. Rule, GS-9, PFT.....Asst. Mgr., Habitat
(Transferred to Turnbull NWR 5/91)
6. Sharon A. Browder, GS-7, PFT.....Asst. Mgr., Trainee
(Transferred to Lee Metcalf NWR 4/91)
7. Rod A. Blacker, GS-11, PFT.....Fire Mgmt. Officer
8. Gary L. Ivey, GS-11, PFT.....Refuge Biologist
9. Rick T. Vetter, GS-9, PFT.....Asst. Refuge Biol.
10. Larry McGowan, GS-9, PFT.....Outdoor Rec. Planner
11. Carla D. Burnside, GS-9, TFT.....Refuge Archaeologist
12. Arlene Miller, GS-7, PFT.....Admin. Support Asst.
13. Debbie Hickey, GS-4, PFT (EOD 1/91)....Office Auto. Clerk
14. Mary Schouviller, GS-4, PFT (EOD 8/90)..Purchasing Agent
(resigned 8/91)
15. Mike Reilly, GS-7, TFT (EOD 5/91).....Asst. Archaeologist
(resigned 10/91)
16. Sally Flatland, GS-5, TFT.....Coop Ed Student
17. Sandy Rule, GS-5, TFT.....Bio. Tech
18. Kathy Brown, GS-5, TFT.....Biological Aid
19. Linda Johnson, GS-1, TFT.....Clerk
20. Sarah Heinz, GS-1, TFT.....Clerk
21. Blake Nuffer, WG-9, PFT.....Maintenance Mechanic
WS-8, PFT (Promoted 5/91).Maintenance Supervisor
22. Marvin L. Jess, WG-10, PFT.....Crane Operator
23. Thomas E. Downs, WG-9, PFT.....Eng. Equip. Operator
24. Clyde R. Miller, WG-9, PFT.....Maintenance Mechanic
25. Bruce F. Aldrich, WG-9, TFT.....Maintenance Mechanic
(Converted from PFT 6/91)
26. John H. O'Connor, WG-9, PFT.....Maintenance Mechanic
27. Art Wittrock, WG-9, TFT.....Carpenter
28. Jim Vanderdasson, GS-5, TFT.....Soc. Services Asst.
WG-8, TFT.....Maintenance Worker
29. Mike Concannon, WG-8, TFT.....Maintenance Worker
30. Karen Maready, GS-5, TFT.....Soc. Services Asst.
31. Michael Calloway, GS-5, TFT.....Range Tech., Fire
32. Dan Browder, GS-5, TFT.....Range Tech., Fire
33. Eric Anderson, GS-4, TFT.....Range Tech., Fire
34. Mark Makely, GS-4, TFT.....Range Tech., Fire
35. Beth Curry, GS-4, TFT.....Range Tech., Fire
36. Kim Kelley, GS-5, TFT.....Range Tech., Fire



Submitted by:

Concurred by:

Concurred by:

Approved by:

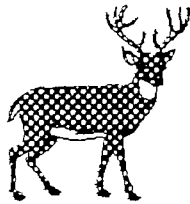
Louise L. Comer
Refuge Manager

Robert R. Rucker
Refuge Supervisor

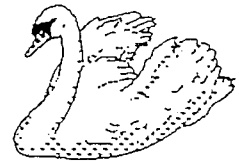
[Signature]
AID - Refuges and Wildlife

[Signature]
Regional Director

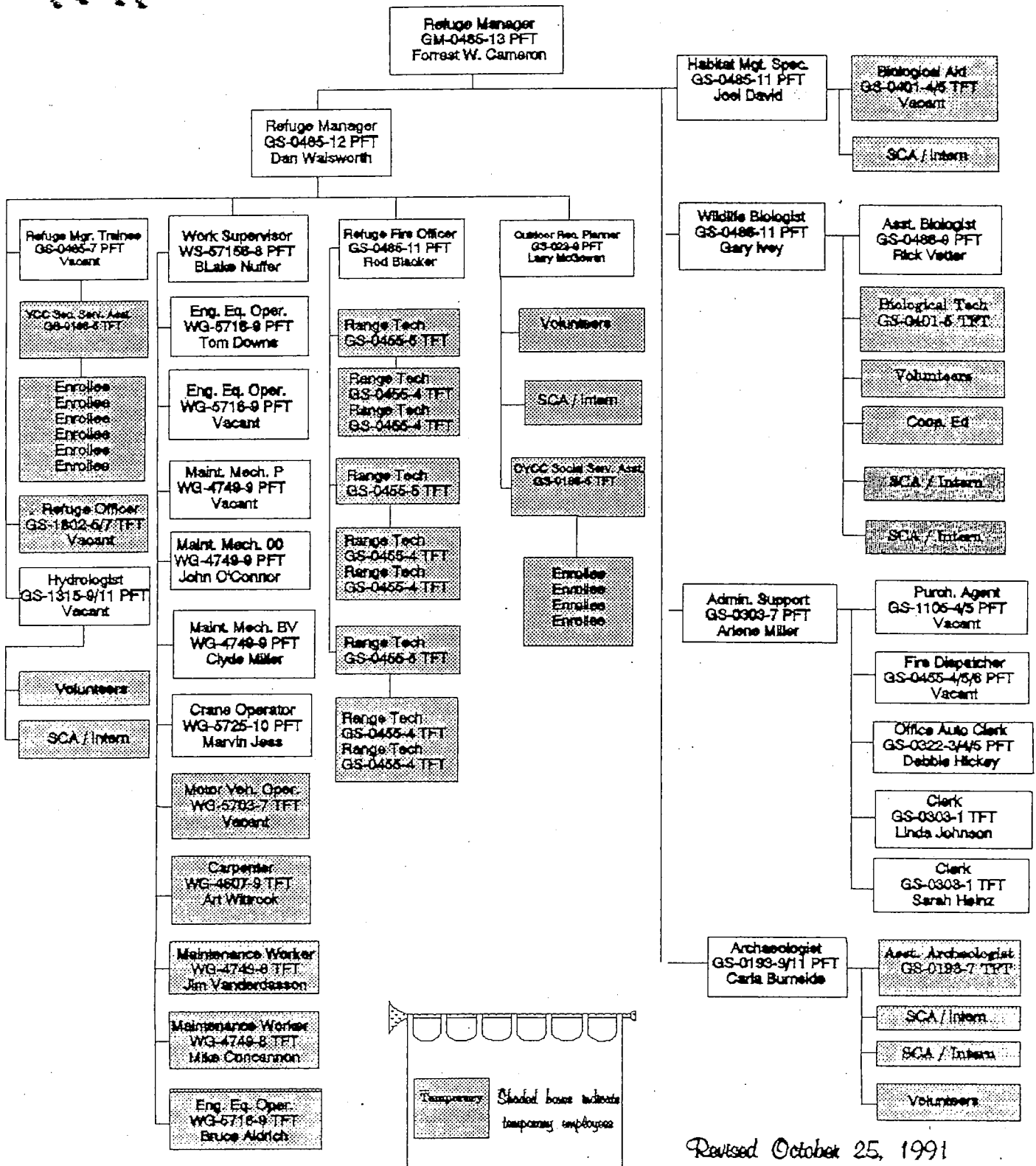
11/7/92
Date



MALHEUR NATIONAL WILDLIFE REFUGE
HC 72 BOX 245
PRINCETON, OR 97721



Proposed Staff Plan - October, 1991



Revised October 25, 1991



Front Row: Larry McGowan, Rod Blacker, Dan Walsworth, Carla Burnside, and Forrest Cameron.
Back Row: Joel David, Rick Vetter, and Gary Ivey. 2/92



Arlene Miller, Sarah Heinz, Linda Johnson, and Debbie Hickey. 2/92



Tom Downs, Blake Nuffer, Clyde Miller, Marv Jess, Jim Vanderdasson, and John O'Conner. 2/92



Sally Flatland 8/91



Sandy Rule 6/91



Kathy Brown 8/91

Table IV Malheur Refuge Personnel Summary, 1987-91.

Fiscal Year	Approved Level Permanent Full-Time	Permanent Part-Time	Temporary
1987	14	1	6
1988	14	1	8
1989	17	0	3
1990	18	0	6
1991	20	0	18

2. Youth Programs

Youth programs in 1991 included both the federally sponsored Youth Conservation Corps (YCC) and the state sponsored Oregon Community Service Corps (OCSC).

Youth Conservation Corps

The 1991 YCC program ran for eight consecutive weeks from June 17 through August 9. Outdoor Recreation Planner Larry McGowan served as the program coordinator. Karen Maready, a local school teacher, was hired as the Social Services Assistant. The six enrollees were: Shawn Hawkins, Brandi Taylor, Shawna Tropf, Connie Whitney, Jeff Stenson, and Jess Wenick.



YCC crew enjoys a trip to Steens Mountain. Left to right are Shawn, Jeff, Brandi, Jess, Shawna and Connie. KM 8/91

This year's YCC crew was very cohesive. They worked as a team to get their projects completed, taking great care in the quality of work accomplished. Work projects included: facility maintenance, landscaping and yard work, fence construction, fence removal, and bridge maintenance. They also built a rock wall and painted a foot bridge at Krumbo Reservoir.

Environmental education activities included assisting with duck banding, helping with duck nest searches, and exploring the Diamond Craters and Steens Mountain Recreation Area. Due to the crew's inquisitiveness about refuge management practices and environmental issues, a lot of time was spent discussing predator control, archaeology, prescribed burning and other contemporary activities. Whenever possible resident staff members were brought in to explain their programs to the enrollees.

Overall this season's YCC program was one of the best ever. The season was very productive and the enrollees participated in a good variety of refuge experiences. One comment that an enrollee said seems to summarize this season's YCC experience. "I learned a lot of new skills this summer. I (also) learned not to be afraid of a big project. You just have to jump in and do it."



YCC enrollees get some hands-on experience with wildlife. RV 7/91



YCC crew marking a cinnamon teal nest during a waterfowl nest search. RV 6/91

Oregon Community Service Corps

In 1991 an Oregon Community Service Corps (OCSC) grant was submitted to the Oregon State Department of Human Resources-Employment Division for a number of building restoration and site improvement projects in Harney County. This enthusiastic project idea was a joint venture among Malheur Refuge, the Malheur Field Station's Great Basin Society, Harney County Chamber of Commerce, and Harney County Training and Employment Consortium. Outdoor Recreation Planner Larry McGowan assisted in the writing of the grant and was in charge of coordinating the refuge portion of the OCSC program. This resulted in the use of a four person crew for eleven weeks of work on the refuge, along with a lot of other projects they did around the county.

Heavy Equipment Certification training was the first order of business for the four "at risk" youths who were to start work on the refuge in June. Dale Green (Klamath Basin Refuges), Robert Wegman (Deer Flat Refuge) and Lane Slover (Sheldon Hart Refuge) were the instructors. This training took place March 18-20. Enrollees Dion Baird, Kevin Hofman, Ray Raines and Eric Herrera (plus ten Malheur Refuge employees) performed and passed the seven steps required by the Service, for certification to operate the following equipment: crawler dozer, backhoe, loader, grader and farm tractor.

Steady work for the crew started on the refuge June 10 and lasted until August 23. Jim Vanderdasson was hired as a Social Service Assistant, to supervise the enrollees for this eleven week time period. Mr. Vanderdasson directly supervised the four enrollees the entire time. However, enrollees changed every so often due to people dropping out, moving away from the area or getting fired. During the eleven week time period on the refuge Mr. Vanderdasson supervised seven different enrollees.

Most of the work on the refuge was conducted at Sodhouse Ranch. Sodhouse Ranch is on the National Park Service Register of Historic Places and an area the refuge management considers to be of historical significance. As a result of flooding in the 1980's, this area was in a terrible state of deterioration and needed immediate attention to prevent a total loss. Work related to Sodhouse included: mowing, trimming, brush removal, cutting juniper fence posts, building fence, window installation, simple building repair, building demolition, landscaping and general facility maintenance.

Other work experiences for OCSC enrollees included: fabrication (welding, sawing, drilling, etc...), motor vehicle maintenance and repair, and heavy equipment operation. The refuge also provided First Aid and CPR training to enrollees who were not yet certified.



Root cellar at Sodhouse Ranch before OCSC crew began restoration work. LM 6/91



Root cellar at Sodhouse Ranch after OCSC crew completed their work on the ranch. LM 12/92

3. Other Manpower Programs

Student Conservation Association volunteers were again participants in the archaeology program at Malheur. Diane McMillen and Joel Walker arrived in June and spent three months working on various projects at the refuge. A good portion of their time was spent excavating human burials from sites flooded during the 1980's. They also spent quite a bit of time collecting and mapping surface artifacts from sites, surveying for newly revealed sites, relocating and documenting all known prehistoric rock art sites on the refuge and a small amount of time was spent with the biological staff.



SCA Diane McMillen screens soil from a burial, while SCA Joel Walker and volunteer Chris Walsworth excavate a burial. CB 6/91

4. Volunteer Programs

The total number of individuals volunteering on the refuge this year was 210. This includes 150 elementary school students who came for a day of tree planting for riparian restoration along Bridge Creek. The total number of volunteer hours contributed in 1991 was 4,471. Volunteer work included bird banding, wildlife and habitat surveys, tree planting, landscaping, administrative assistance, staffing the headquarters on weekends, surveying and map making, general facility maintenance, archaeology, and assisting law enforcement personnel in resource protection.

Most volunteer work on the refuge occurs between the John Scharff Migratory Bird Festival in early April and the end of October. The headquarters area is staffed by volunteers during most weekends in the spring when visitation and warbler migration is at it's peak. Without annual projects like the on-going juniper rip rap project on the Blitzen River or the local school children doing their tree planting, many beneficial activities would never get accomplished.



Volunteers wire juniper trees to the banks of the Blitzen River. LM 8/91

5. Funding

Table V Malheur Refuge Funds, 1987 -1991.

FISCAL YEAR (FUNDS IN DOLLARS)

FUNDS SOURCE	1987	1988	1989	1990	1991
1261 BASE					475,000
YCC	12,800	10,000	12,000	13,000	13,000
FISH MGT	0	0	24,000	0	0
CHALLENGE GRANT	0	0	3,500	33,000	125,000
FIRE	0	0	20,000	18,300	(18,800)
ARCHAEOLOGY	0	0	0	50,000	200,000
1261 TOTAL	12,800	10,000	59,500	114,300	813,000
1262 BASE	0	0	0	0	303,000
MMS	0	0	0	100,520	50,000
1262 TOTAL	0	0	0	0	353,000
TOTAL 126X FUNDS	630,800	643,000	724,000	888,520	1,166,000
1120 Farm Bill /AFWE	0	0	0	0	30,481
1230 Farm Bill /NAWMP	0	0	0	0	7,000
1240 (FIRE)	37,500	60,000	78,500	0	0
6860 (SALES)	21,000	30,000	40,000	30,000	30,000
8610 (QTRS)	8,100	5,300	9,350	29,700	14,000±
91XX (FIRE) FUNDS					
(9110)	0	0	0	(25,000)	(37,000)
(9120)	0	0	0	(130,700)	(101,700)
TOTAL 91XX FUNDS				155,700	138,700
9220-1160-Kado Fire Rehab.					(76,300)
9220-1157-Diamond Fire Rehab.					(50,130)
TOTAL 92XX FUNDS					126,430
GRAND TOTAL	710,200	748,300	851,850	1,103,920	1,512,611

() = Included in total for subactivity

5. Funding

The special project funding continues to bolster our budget, but it does not come without constraints and commitments. So far the price of such funding sources has been bearable and allows support of our base 126X needs. Soft money is certainly not preferred, but it is the only way we can make progress against our restoration backlog. Especially exciting is the community response to our private wetland enhancement projects.

6. Safety

Station safety meetings were held in conjunction with the periodic full-staff meetings. The station chairman for the year was Larry McGowan. The staff also completed an eight hour OPM Defensive Driving course.

During the second week of June, YCC enrolles, Oregon CSC and their group leaders, along with the fire and archaeological crews, attended multimedia first-aid and CPR training in Burns. Instruction was provided by the Burns Ambulance crew.

Seasonal firefighters joined BLM fire coordinators and their seasonal fire crews for the annual "Fire Training Week" in Burns the beginning of June. Basic firefighting courses, fire shelter deployment, and pumper operation training were completed at this time.

7. Technical Assistance

Biologist Gary Ivey taught a class through the Malheur Field Station on field techniques for conducting studies of breeding waterfowl, marsh birds, colonial nesting waterbirds, and shorebirds. The course was held in May and David Mauser of Klamath Basin Refuges assisted in teaching the class. Three of the seven students were refuge biologists, one worked for the Environmental Protection Agency, one for the Forest Service, one from Oregon Department of Fish and Wildlife (ODFW), and one was a wildlife student from Evergreen University. The course was primarily conducted in the field, where students learned techniques such as identifying species, conducting waterfowl pair counts, conducting searches for nests, identifying nests, determining nest fates, collecting nest data, identifying broods, conducting brood counts. Also covered in the course were methods of estimating production using models and statistical applications such as the Mayfield method for determining nest success.

Gary also provided training in field techniques for nesting waterfowl and banding techniques to a group of about 30 ODFW personnel and one BLM biologist at Summer Lake Wildlife Area in June. David Mauser also assisted with this training.

In September, Gary Ivey and Joel David hosted a tour of the refuge by Linda Poole and Verne Marr, The Nature Conservancy biologists from Sycan Marsh Preserve. They came to Malheur to discuss management of vegetation, livestock as a management tool, and noxious weed problems. They planned to use some of our suggestions to update their grazing plan for the preserve.

Biologist Ivey attended a meeting in Portland in November to assist ODFW in coordinating fall waterfowl surveys and to discuss strategies for a state-wide breeding waterfowl survey to be started in 1992.

As a follow-up to the Mongolian Delegation's 1990 visit to Malheur, two ex-Malheur Refuge staff (Richard Voss and David Johnson) visited wildlife preserves in Inner Mongolia to provide advice for management of their Preserve System.

Carla Burnside, refuge archaeologist, assisted Anan Raymond, regional archaeologist, with a cultural resource clearance project at Hanalei Refuge on the island of Kauai. Carla and Anan spent a week in May drawing and describing the stratigraphy of three trenches placed in an area where a brood pond is planned.

Carla joined Anan Raymond and Cliff Creger, Stillwater Refuge archaeologist, in October for a weeklong cultural resource survey at Clear Lake, Klamath Basin Refuge Complex. Drought conditions forced record lowering of the lake by the Bureau of Reclamation and revealed numerous archaeological sites along the shore. The survey was initiated to identify archeological sites that were being looted by collectors, so that refuge law enforcement officers could combat the problem more efficiently. The surveyors also looked at several areas proposed for dredging or channeling to allow passage of indigenous suckers from the lake to spawning areas cut off by low water levels.



In 1990, a delegation of Managers from Mongolia visited Malheur to learn about management of the refuge system. GI 8/90



Biologist Rick Vetter demonstrating an egg candling procedure to Dr. Karl Holte during his annual aquatic plant course at the refuge. SS 7/91

F. HABITAT MANAGEMENT

1. General

Malheur Lake drastically receded in 1991, after reaching a record peak elevation in 1985. In February, the lake elevation was 4093.87, and by early December it had lowered to 4091.00, a decline of 2.87 feet. In September, Malheur Lake became isolated from Mud Lake. After that time, Malheur Lake elevations were only estimates because the staff gauge was isolated at the Narrows. The declining lake left many isolated ponds and extensive areas of barren mudflats.

Emergent vegetation on Malheur Lake expanded significantly in 1991. Due to the flooding of the early 1980's emergent vegetation was absent from Malheur Lake for five years, and first reappeared in 1990. This year, the most significant emergent growth was at the mouth of the Blitzen River, near headquarters, where cattails, burreed and hardstem bulrush appeared. About 200 acres of alkali bulrush appeared east of Cole Island Dike, and small stands of this plant were found scattered on the west side of the lake as well. Hardstem bulrush also appeared in small, scattered stands on the west side of the lake.

Drought conditions set in by mid-winter and had the staff concerned about water availability for breeding waterfowl. However, due to a very wet, late spring, the Blitzen Valley experienced a near average water year. Water availability was adequate to irrigate most units through early summer. This provided good habitat for nesting cranes and breeding waterfowl. Low water availability in late summer required directing water to high priority brood ponds and crane feeding areas. In general, late season water was considerably below objectives.

For the second year in a row, there was low snow accumulation in the Silver Creek drainage. This resulted in no irrigation water for the northern portion of the Double 00 unit. Major ponds in this portion of the unit (Derrick Lake, Warbler Pond and Martha Lake) were maintained during the winter with water from springs, creating excellent waterfowl pairing habitat. However, drought conditions and diversion of spring water to irrigate the southern half of the unit resulted in many of these ponds receding well below operating levels by mid-summer, severely restricting waterfowl brood habitat. Perennial springs helped maintain excellent habitat conditions throughout the summer in the southern portion of the unit.

2. Wetlands

Water supplies in the Double-O Unit were poor, as irrigation water was not available from Silver Creek because of an absence of runoff for the second consecutive year. Major ponds in the north portion (Derrick Lake, Warbler Pond, Martha Lake, Avocet Pond) were maintained during the winter using water from springs. Beginning in April, the spring water was diverted to irrigate the southern half of the unit. By mid summer, about two-thirds of the wetlands in the north portion of the Double-O were dry.

The Blitzen Valley experienced an unusual water year. Water runoff was predicted to be 52 percent of normal in early March. Extensive spring rains brought precipitation totals to about 102 percent of normal by late May. Unfortunately, the rains came at the wrong time for nesting birds, as many crane, goose, and duck nests were flooded. The May rains did result in excellent refuge grain crops this year.

Aquatic plant surveys were conducted in most major ponds in the Double-O and Blitzen Valley units between August 13 and September 4. No formal survey was taken in Malheur Lake as high turbidity from carp and wind continued to prevent submergent plant growth. Overall quality ratings of the ponds were as follows: 23 percent excellent, 27 percent good, 23 percent fair, 19 percent poor, and 8 percent dry. Quality ratings are defined in the Malheur Refuge Wildlife Habitat Inventory Plan.

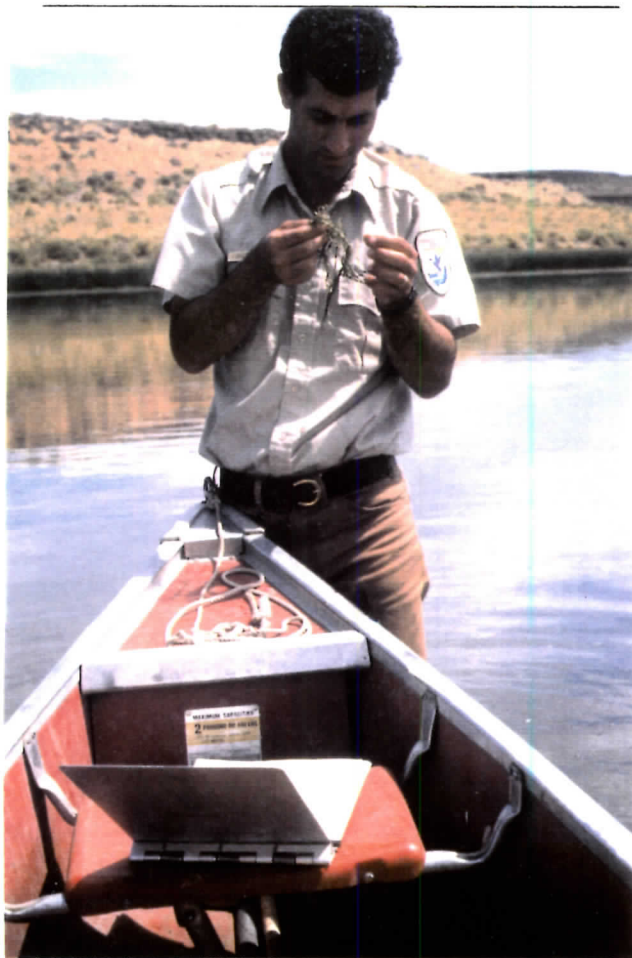
Water supplies in 1991 were generally normal in the Blitzen Valley, and dry in the Double-O. Overall quality ratings were higher than in 1990, a dry year. In 1991, 50 percent of ponds rated excellent or good compared with 41 percent in 1990 and 47 percent in 1989.

Aquatic plant survey data for refuge ponds is summarized in Table VI. Table VII summarizes estimates of aquatic plant acreages for the major refuge ponds and for the lakes. Although no formal surveys were conducted on the lake units, about 15 acres of sago pondweed was observed in Malheur Lake, in some shallow ponds at the mouth of the Blitzen River. During fall waterfowl flights, extensive plant beds were discovered in Harney Lake which contained an estimated 5,000 acres of unidentified submergent plants.

Total estimated acres of submergents in 1991 were 5,870 (5,150 acres in the lakes, 9 acres at Double-O, and 861 acres in the Blitzen Valley). Double-O submergent acreage declined from 1990, while acreage in the Blitzen Valley was 24 percent higher. There were no aquatic plants found in the lakes in 1990, so improvement was substantial in these areas. During an early November waterfowl count, about 40,000 ducks were found utilizing the aquatics on Harney Lake.



Alkali bulrush and other marsh emergents appeared in significant amounts in Malheur Lake for the first time since the flood of the 1980's drowned out the marsh. GI 8/91



Habitat Specialist Joel David conducting an aquatic plant survey. GI 8/91

Table VI Summary of Aquatic Plant Survey Data Collected from Ponds on Malheur Refuge in 1991.

UNIT	POND NAME	QUALITY RATING	AVERAGE CLARITY (cm)	DOMINANT* VEGETATION	CARP INDEX**
1	Warbler Pond	fair	21	POPE/MYEX	1
1	Derrick Lake	poor	18	POSP	4
1	Dune Pond	good	52	POPE	1
1	Tule Pond	fair	7	POPE	1
7	Pintail Pond	good	40	POPE	3
7	Wright's Pond	excellent	21	POPE	2
8	Unit 8 Pond	fair	90	MYEX	3
8	E. Buena Vista	good	40	POPE/MYEX	3
8	W. Buena Vista	good	34	POPE/MYEX	1
8	Coot Pond	fair	13	MYEX	4
9	Skunk Farm Pond	excellent	64	POPE	2
9	Unit 9 Pond	excellent	30	POPE	1
9	Diamond Swamp	excellent	--	POPE	2
10	Grain Camp	good	14	POPE	1
10	Krumbo Swamp	good	50	MYEX/POPE	1
10	Witzel Pond	excellent	35	PONO/POPE	2
11	Boca Lake	good	8	ZAPA/POPE	1
11	Benson Pond	fair	11	POPE/PONO	3
11	Dredger Pond	poor	24	POPE	4
11	Jones Pond	poor	26	ALGAE/POPE	4
11	W. Swamp	poor	29	ALGAE	5
12	Rail Pond	poor	60	POPE	3
12	Knox Swamp	excellent	70	POPE	1
12	Darnell Pond	fair	20	POPE	3

<p>* VEGETATION ABBREVIATIONS:</p> <p>POPE= <u>Potamogeton pectinatus</u></p> <p>PONO= <u>Potamogeton nodosus</u></p> <p>MYEX= <u>Myriophyllum exalbescens</u></p> <p>VEAM= <u>Veronica americana</u></p> <p>URVU= <u>Utricularia vulgaris</u></p>	<p>** CARP INDEX:</p> <p>1= No carp</p> <p>2= Few carp</p> <p>3= Moderate carp numbers</p> <p>4= High carp numbers</p> <p>5= Carp up to our elbows!</p>
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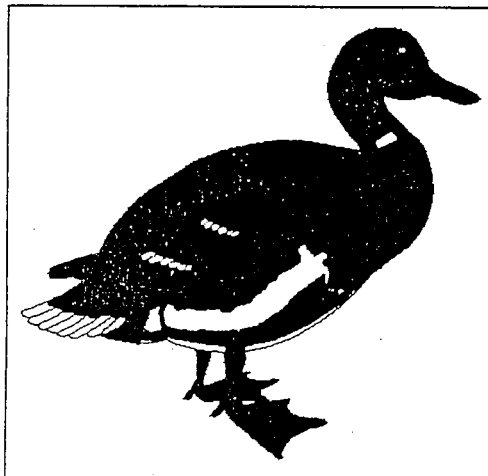


Table VII Estimated Acreages of Submergent Plants in Major Ponds within each Biological Unit at Malheur Refuge, During Aquatic Plant Surveys, 1988-91.

BIOLOGICAL UNIT	ACRES OF SUBMERGENTS			
	1988	1989	1990	1991
1	41	83	35	9
2	0	0	0	5000
3	0	0	0	0
4-5-6	0	0	0	15
7	105	122	70	21
8	37	82	195	330
9	15	58	45	80
10	44	26	27	37
11	129	128	243	261
12	105	203	78	117
TOTAL	476	702	693	5870

1991 Pond Management Actions:

Dry Ponds

The Double-O Unit did not receive any irrigation water from Silver Creek in 1991, due to drought conditions. Consequently, Rock Island Pond remained dry for a second year.

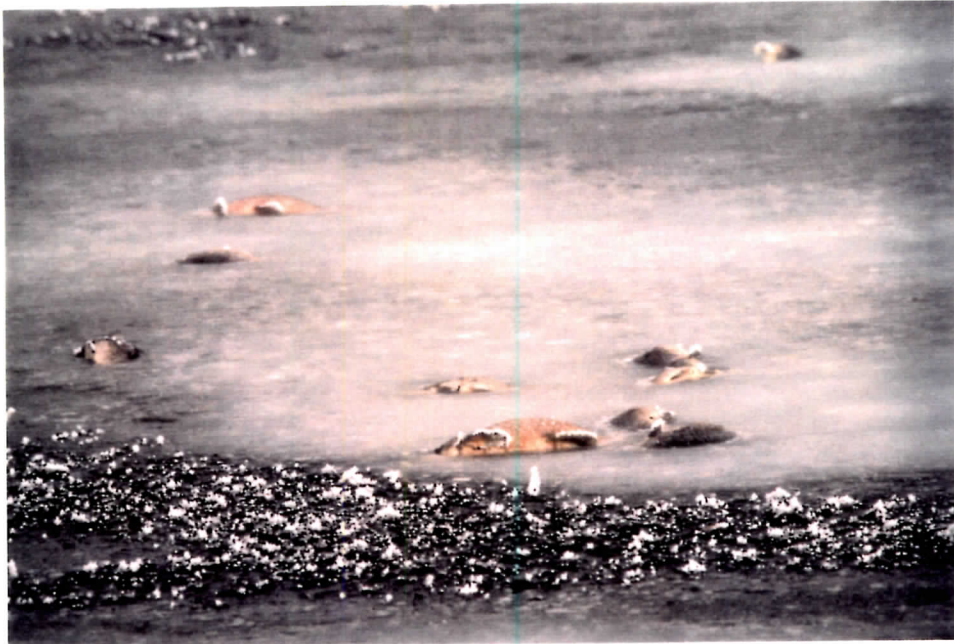
In the Blitzen Valley, Donner and Blitzen ponds also again remained dry. Because of washouts in the Ram Ditch, these areas haven't been managed for several years. The Ram Ditch and many of the dikes in this irrigation system were repaired in 1991. Lava Beds Pond remained dry as well.

Carp Control

Carp were controlled with fall drawdowns in Wright's, Pintail, Little Sagebrush, Unit 8, Coot, Unit 9, Benson, Dredger, Jones, and Darnell ponds.

Burned Ponds

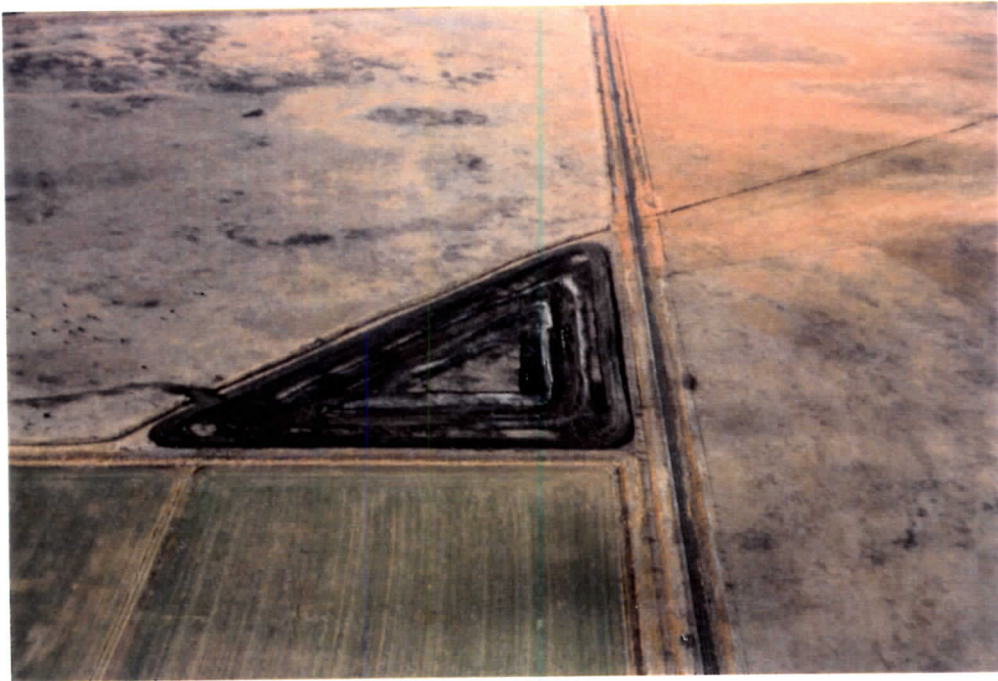
Diamond Swamp was burned during a wildfire in October 1990. The result of the fire was greatly improved marsh interspersation during 1991. Cottonwood, 5-Mile and Baker ponds were burned during prescribed burns in February.



Thousands of carp died when they were frozen in the ice of Malheur, Mud and Harney Lakes. GI 1/91



Windmill Pond was constructed in 1990 and filled in 1991. This pond was built with matching funds from Ducks Unlimited. GI 4/91



A 1991 "Partners for Wildlife" project, this 7 acre pond was built by refuge staff at Section 5 Headquarters of the Squaw Butte Agricultural Experiment Station. Partners in this project included the Experiment Station, Oregon Department of Fish and Wildlife, the Bureau of Land Management and the US Fish and Wildlife Service. GI 9/91



A good stand of rye developed in the grain field at Double "O", however, invasion of whitetop considerably reduced the quality of the crop. JO 6/91

4. Croplands

Our grain program is geared towards fall maintenance of the greater sandhill crane populations. The Cranes stage on the refuge before heading on south to the Central Valley of California. After a four year involvement with a cooperative farming program, the refuge went to a contract farmer to have 250 acres placed in grain production for 1991. This acreage is significantly less than the planned 1200 acres for the prior year (1990). Results from 1990 were so poor that we hoped with a quality planting, we would be much better off this year even with the decreased acreage.

Joe Langford, low bidder, was awarded the contract in early March and soon began to plant 250 acres of barley in the West Knox, East Grain Camp, and River Fields. Total cost for the discing and drilling operation was \$4950.00 or \$19.80 per acre.

Heavy spring rains helped the crop get off to a good start. Both quantity and quality of the fall grain crop was excellent. Total estimated tonnage produced by the planting was at 75 tons. This compares with a Blitzen Valley Management Plan proposed 190 tons on 1200 acres.

5. Grasslands

For the purposes of management at the refuge, grasslands are divided into two basic habitat types: uplands and meadows.

Uplands

Uplands are defined as those areas where basin wildrye, sagebrush and their associated species dominate the vegetative composition at ecological climax. These areas are managed for wildlife by providing periodic treatment to insure vigorous plant growth and to maintain residual nesting cover. The primary treatment involves prescribed burning on a 10 year frequency followed by non-use.

The habitat monitoring and classification program has made it possible to identify current and potential habitat conditions and to monitor trends in habitat condition for 23,300 acres of uplands in the Blitzen Valley. Results show that overall cover conditions have improved significantly in the uplands during the past 15-20 years. Uplands are providing cover at or near their potential in about 90 percent of the uplands in the Blitzen Valley. Habitat monitoring in the spring of 1991 has documented that upland conditions in many fields of the north Blitzen Valley are stabilized. This is especially true in the North West Big Sage, Center Sage, Little Sagebrush and North Meadow B Fields. Additional improvement is still needed in the Rockford Lane, West Wright and Jenkins Fields. Those fields in the south Blitzen Valley that contain significant

acreage of high potential nesting uplands are all in excellent condition.

The status of high potential uplands in fields where upland nesting cover is a management priority is identified in Table VIII. The Percent of Potential figure shows what percent of the uplands in these fields are providing the maximum amount of residual nesting cover. For example, a figure of 50 percent would show that half of the uplands are providing optimum cover, while a value of 100 percent shows that all of the uplands are at their potential for providing nesting cover.

The Double-O, Harney and Malheur Lake Units have not yet been inventoried and classified under this system. Based on general observations, the condition of upland cover in the Double-O area is summarized in Table IX. A management plan will be developed for this area during 1992 to correct problems existing with upland habitat.



Electric fence
being used to
protect upland
habitat from a
grazed meadow.
JD 12/91

Table VIII Current Status of High Potential Uplands, Blitzen Valley.

FIELD	ACRES	HIGH POTENTIAL UPLAND ACRES	% AT HIGH POTENTIAL		TREATMENT 1991
			1990	1991	
Coyote Butte	1119	154	100	100	Idle
West River	60	25	10	10	Idle
Thoroughbred	735	319	100	100	Idle
N.W. Big Sage	4127	1424	35	55	HO
Center Sage	2718	572	0	60	LRBG
Rockford Lane	2474	607	36	23	Idle
N.E. Wright	265	38	100	100	Idle
W. Wright	1111	461	85	69	Idle
S. Wright	1899	347	100	100	Idle
W.E. Big Sage	1385	188	100	100	LRBG
E.E. Big Sage	2047	648	100	100	Idle
Little Sagebrush	1393	429	10	84	Idle
U-8 Duck Pond	1345	201	100	100	Idle
Jenkins	700	322	71	60	LRBG
N. Meadow A	280	48	10	0	RBG
N. Meadow B	413	101	3	84	RBG/HO
E. House	129	15	0	0	HO
Oliver Springs	1167	152	100	*	Idle
Skunk Farm	932	91	100	*	GO
Krumbo Reservoir	894	69	100	*	Idle
N. Boca Lake	265	23	100	*	Idle
S.W. Bridge Crk	578	57	100	*	Idle
Big Dry	835	77	59	*	HO
Knox	606	118	100	*	Idle
Knox #5	199	125	100	*	Idle
N. Little Junip.	684	142	100	*	HO
S. Little Junip.	521	44	85	*	Idle
Island	808	91	87	*	HO
W. Big Juniper	493	145	100	*	HO
E. Big Junip. Ex.	81	18	100	*	RBG
Barley	212	27	65	*	HO
Big Deer Park	942	116	35	*	Idle
TOTAL		31,417	7,164		
Treatment Types					
Idle - No use for at least one growing season					
HO - Hay only					
RBG - Rake Bunch					
LRBG - Light Rake Bunch Graze					
GO - Graze Only					
* - Uplands not monitored for 1991					

Table IX General Cover Conditions of Uplands in the Double-O Unit.

Field	Acres	Treatment	General Cover Conditions
Peterson	773	Idle	Poor
Rock Island	620	Idle	Poor
Plow	320	Idle	Fair
Grain	367	Idle	Poor
North Chappo	1483	Idle	Fair
South Chappo	495	Idle	Fair
N. Stinking Lake	410	Idle	Good
Stinking Lake RNA	1500	Idle	Excellent
Redhouse	678	GO	Good
Martha Lake	2972	Flooded	Excellent
West Freeman	432	GO	Fair
East Freeman	833	Idle	Fair
Cow Pasture	458	Idle	Excellent
Willard	456	HO/RGG	Fair
Hughett	364	HO/RBG	Fair
Upper Swamp	255	RBG	Fair
Yriarte	502	RBG	Fair
Lower Swamp	2348	Idle	Fair
Treatment Types			
Idle - Non-use at least one growing season			
HO - Hay Only			
RBG - Rake Bunch Graze			
Flooded - Water added during fall\winter			

Meadows

Meadows include the zone between the upland sites and emergent marshes where moist, sub-irrigated or seasonally flooded soils favor the production of grasses, rushes, sedges and water-tolerant plant species. A variety of treatments are conducted on the meadows (haying, grazing, idle and prescribed burning) to provide diverse conditions for wildlife. Treatment intensity is the primary factor used to monitor meadows. Treatment intensity is defined as the percentage of biomass removed or damaged in relation to pre-treatment conditions.

Under the Blitzen Valley Management Plan, meadows are managed to provide treatment at an intensity of 60 percent removal of meadow vegetation on 60 percent of the meadow area. Table X provides a summary of treatments applied to meadows in the Blitzen Valley during the 1990/91 season.

Meadow treatment types for the Double-O have been mapped, but acreage figures will not be available until the refuge

Geographic Information System (Arc/Info) becomes operational for this area.

Table X Acreage and Percentage of Meadow Treatments in the Blitzen Valley, Malheur Refuge.

TREATMENT INTENSITY	ACRES	PERCENT
Idle (no use)	7,794	40.0
Graze Only (light use)	2,560	13.0
Rake-Bunch Graze	5,995	31.0
Hay Only	2,420	12.0
Prescribed Burn	798	4.0
TOTAL for Blitzen Valley	19,567*	100.0
(* Difference from total figure reported in the 1990 narrative reflects conversion of some grain fields back to native meadow)		



Aerial view of Jenkins field. Grazed meadows interspersed with uplands. GI 9/91

6. Other Habitats

Woody riparian zones are managed to provide optimum conditions for a multitude of species including red-band trout, willow flycatchers and other songbirds. Management includes efforts to protect these areas from disturbance and promote healing of areas previously disturbed.

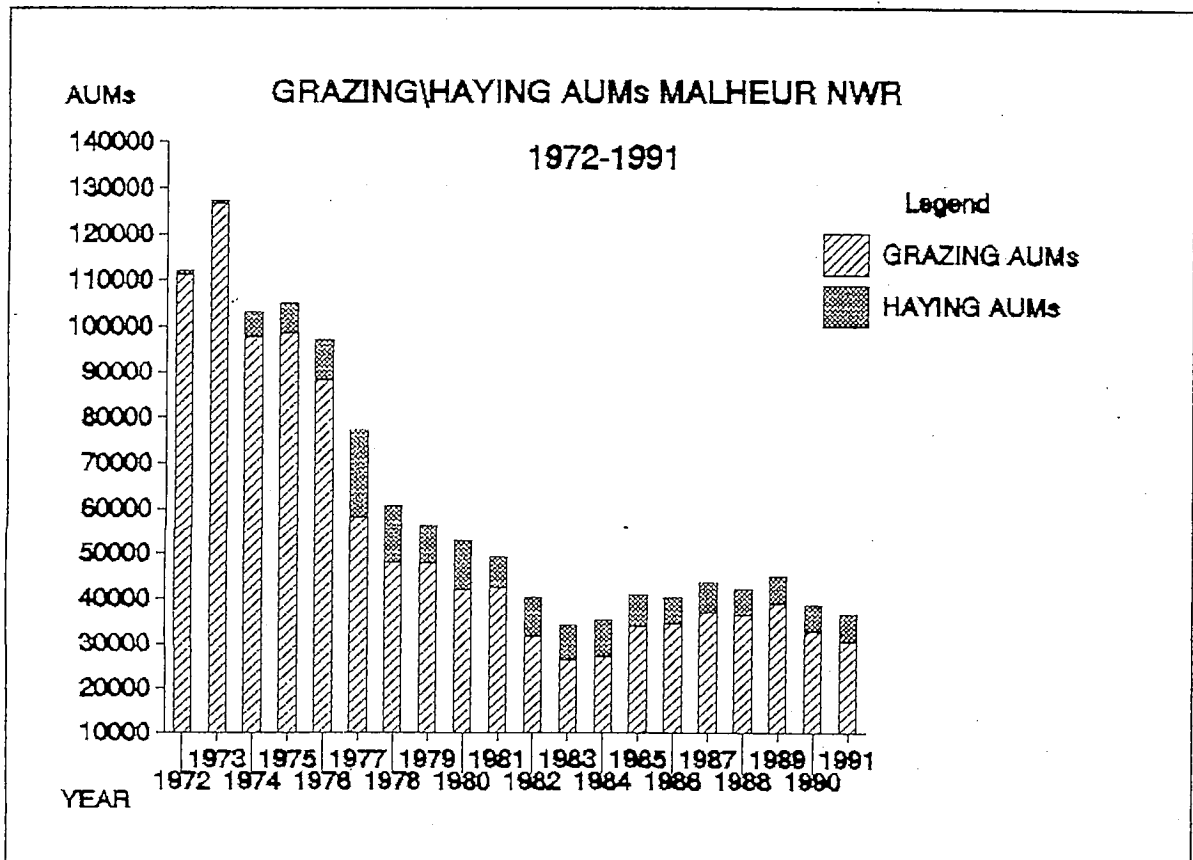
The habitat monitoring program shows that riparian zones are currently in good condition and are improving in virtually all sections of the Blitzen Valley.

Stream habitat enhancement work has been carried out along the Blitzen River near P-Ranch for the fourth year through a cooperative effort with Trout Unlimited, Department of Fish and Wildlife, and Oregon Trout. This years work involved placement of 160 feet juniper rip-rap and rock jetties to stabilize stream banks and promote recovery of riparian vegetation. (See section G-11) Approximately 100 willows and 50 hybrid poplars were planted along the riverbanks.

7. Grazing

In the 1990/91 season, a total of 30,464 Animal Unit Months (AUMs) of forage were removed by grazing. This is a 7 percent decrease over the 1989/90 season level of 32,736 AUMs and a twelve percent decrease over the 88/89 level of 36,268 AUMs. This decrease can be attributed, in part, to full implementation of the Blitzen Valley Management Plan.

Figure I Summary of Refuge Grazing Levels From 1972 - 1991.



During the 1990-91 season, 47 fields were grazed totalling 27,164 acres, or about 29 percent of the 92,252 grazable refuge acres. No grazing took place during the growing season.

Rake-bunch grazing is a treatment strategy used to create open shallow flooded areas for early season waterfowl pairing and feeding habitat. Meadows are cut in August when protein levels are about 8-10 percent. This vegetation is then raked into bunches and left until mid-winter. Cattle graze these bunches of higher quality forage. Adjoining uplands are not supposed to be impacted since the protein levels in these areas are much lower than in the rake-bunches. However, impacts to uplands can occur during harsh winters when forage consumption is greatly increased, and when fall rains and warmer weather cause regrowth of upland grasses. As a general rule of thumb, if only 60% of the meadow forage is allocated during an average year, livestock impacts are minimal in adjacent upland cover and willow riparian habitat.

Biomass production on refuge meadows averages about 2,800 pounds per acre in a normal year, but can range from 800-4500 pounds per acre per year depending on annual moisture. About 85 percent of this biomass is usable as livestock forage when a rake-bunch graze treatment is applied. Using the standard AUM figure of 800 pounds of forage, it follows that a treatment which allows for three AUMs per acre grazing intensity would remove 2400 lb of forage on a meadow site. Table XI summarizes the grazing treatments in refuge fields during the 1990-91 grazing season. Treatment intensity is expressed in AUMs per acre.

Fields with a grazing intensity below 0.5 AUMs/acre generally contain significant areas of nesting uplands or willow riparian habitat. Grazing intensities greater than 1.0 AUM/acre are applied to broad flat fields with extensive emergent marshes that require some treatment by livestock to create open water areas for waterfowl pairing habitat. Grazing intensity was lowest (.02 AUMs per acre) in the South Swamp Field. This is a large marsh area with little meadow interspersed in the unit. Grazing provides some openings in the hardstem bulrush marsh. The most intensively grazed fields on the refuge were the East Big Juniper Field (6.0 AUMs/acre) and the West South Meadow Field (6.1 AUMs/acre). These fields are rake-bunch grazed to provide a wildlife feeding and pairing area. In addition, hay that was cut and baled on adjacent fields, where protection of uplands and riparian habitat is critical, is fed off on these fields to provide greater treatment impacts to dense, overgrown stands of cattail and bulrush. These fields are surrounded by idle fields which provide excellent nesting cover.

Table XI Summary of Grazing Treatments and Intensity on Malheur Refuge Fields During the 1990-91 Grazing Season.

Permit Type	Field Name	Treatment	Acres	AUMs	AUMs/Acre
Reg	Rock Island	GO	620	037	0.1
Reg	Redhouse	RBG	678	543	0.8
Reg	West Freeman	RBG	432	184	0.4
Reg	Martha Lake	RBG	2972	419	0.1
Reg	Upper Swamp	RBG	255	990	3.9
Reg	S. Stinking Lake	RBG	615	231	0.4
Reg	Yriarte	RBG	502	862	1.7
Reg	Willard	RBG	456	689	1.5
Reg	Hughett	RBG	364	691	1.9
Reg	S. Sodhouse	RBG	382	1267	3.3
Reg	N. Sodhouse	GO	579	500	0.9
Reg	W. E. Big Sagebrush	RBG	1385	709	0.5
Reg	Center Sagebrush	RBG	2718	1622	0.6
Reg	West Wright	GO	1111	572	0.5
Reg	South Center	RBG	363	823	3.2
Reg	N. Meadow B	RBG	414	236	0.6
Reg	Larson	RBG	501	524	1.2
Reg	Rimrock	RBG	577	918	1.6
Reg	Jenkins	RBG	700	248	0.3
Reg	South Swamp	GO	1320	029	***
Reg	Retherford Lake	RBG	960	334	0.3
Reg	Tipton	RBG	368	320	0.9
Reg	N. Meadow A	RBG	756	451	0.6
Reg	West Center	RBG	273	1267	4.6
Reg	N. Swamp	RBG	704	118	0.2
Reg	East Center	RBG	160	392	2.4
Reg	Witzel	RBG	156	740	4.7
Reg	Lower Krumbo # 1	RBG	157	526	3.3
Reg	Lower Krumbo # 2	RBG	101	263	2.6
Reg	Upper Krumbo	GO	233	100	0.4
Reg	South Krumbo # 2	GO	178	205	1.1
Reg	E. Upper Grain Camp	RBG	145	335	2.3
Reg	Dredger #1	GO	779	190	0.2
Reg	Jones	RBG	759	1843	2.4
Reg	South White	RBG	379	798	2.1
Reg	Warm Springs	RBG	291	818	3.1
Reg	E. Big Juniper	RBG/SAF	239	1444	6.0
Reg	Faye	RBG	650	1714	2.6
Reg	West South Meadow	RBG/SAF	427	2625	6.1
Reg	N. Meadow	RBG	414	892	2.1
TOTALS:			28,576	32,849	1.1
O = Hay only RBG = Rake-Bunch-Graze Reg = Regular Permit GO = Graze Only					

8. Haying

Haying is used as a management strategy when it is desirable to provide mowed meadow conditions, but it is necessary to protect adjacent uplands and riparian zones. Under this treatment, the permittee is required to cut, bale and remove the vegetation. Most haying is accomplished in early August. The amount of forage removed using this strategy has remained fairly constant during the past 12 years at about 2500 to 3000 tons per year. Figure I summarizes the level of haying since 1972. Table XII shows tons of hay removed in the past 5 years. Table XIII summarizes the haying program for the 1990-91 season.

Table XII Summary of Actual Forage Removed by Haying in the Last 5 Seasons.

PERMIT TYPE	1986/87	1987/88	1988/89	1989/90	1990/91
Regular Hay Tons	1,066	580	513	532	2,501
HCEFP Hay Tons	1,674	1,825	1,957	1,856	0
TOTAL HAY TONS	2,743	2,405	2,470	2,388	2,501

Table XIII Summary of Hay Removal by Field for 1990-91 Season.

TYPE OF PERMIT	FIELD NAME	ACRES TREATED	TONS REMOVED	TONS /AC
Reg	Hughett	200	147	0.73
Reg	NW Big Sage	812	269	0.33
Reg	N. Meadow B	161	046	0.28
Reg	South Center	153	137	0.89
Reg	W. Grain Camp	197	080	0.40
Reg	M. Grain Camp	118	121	1.02
Reg	Baker	354	160	0.45
Reg	Big Dry	557	500	0.89
Reg	N. Little Juniper	198	140	0.71
Reg	Bridge Creek	438	396	0.90
Reg	Island	333	326	0.98
Reg	Barley	100	150	1.50
Reg	Warm Springs	022	029	1.32
TOTALS:		3643	2501	0.69



The first evidence of mowing mortality on young cranes was documented in January when this young crane was found in one of the Blitzen Valley fields. GI 1/92



A grazing permittee uses an old fashion rake on one of the treated meadows in the Double "O" unit. JO 8/91

9. Fire Management

The 1990 Malheur Refuge fire season started in February and continued until October. More fires (5) than average (3.1) burned less acres (813) than the past 10 year average (1054). Interagency agreements with the BLM have enabled the refuge to use the "closest forces" concept during initial attack of fires on or next to the refuge. The Burns BLM dispatch assigns refuge crews to off-refuge interagency fires. The dual agency Frenchglen Fire Station has improved response time for both agencies on the south end of the fire district. Shared costs of this facility has also benefitted both agencies. Programming other agency frequencies on refuge radios via the BLM radio maintenance contract produced cost savings due to faster response times on at least 16 wildfires this year.

Refuge crews responded to 47 fire incidents and took action on 20 wildfires and 14 prescribed burns. Of these, 5 wildfires and 8 prescribed burns were on Malheur Refuge. Total acreage burned on Malheur Refuge was 2442.5. The refuge aided the Burns BLM District on 13 off-refuge wildfires (9044.3 acres), Finley Refuge on 1 wildfire (220 ac.), and the USFS on 2 wildfires (952 ac.). They also went on standby and responded to false alarms as an interagency resource. Table XIV shows refuge fire responses.

Malheur deployed the following resources to regional suppression efforts:

- ▶27 engine assignments for 43 days
- ▶2 dozer assignments for 6 days
- ▶1 prescribed burn assignment for 5 days (1 engine & 6 people)

The engine and dozer assignments were to BLM, FWS, and USFS fires in Oregon; the prescribed burn crew went to Finley Refuge near Corvallis, Oregon. A refuge operator and tractor/low-boy trailer went with the dozer.

Refuge firefighting personnel conducted eight prescribed burns on the refuge and six prescribed burns on Finley Refuge this year.

1991 MALHEUR REFUGE FIRE RESPONSES

Table XIV

DATE	FIRE #	OWNER	FIRE NAME	PEOPLE	EQUIPMENT	REMARKS	ACRES
2/26/91	1013	FWS	Jones	4	#15, #16, Grader	Prescribed Burn	345
2/27/91	1011	FWS	Faye	9	#15, #16, Grader	Prescribed Burn	978
2/27/91	1209	FWS	Knox	9	#15, #16, Grader	Wildfire	663
2/28/91	1012	FWS	N Jones	2	#15	Wildfire	150
3/3/91	1210	FWS	P-Ranch	1	Bean Sprayer	Prescribed Burn	0.5
3/14/91	1015	FWS	Double - O	6	3 Engines, D4, Tractor w/Mower	Prescribed Burn	203
3/15/91	1211	FWS	Double - O	1	Bean Sprayer	Prescribed Burn	0.5
5/2-6/91	1026	USFS	Stevens-Canyon P60791	3	#16	Wildfire	950
6/20/91	1212	FWS	Library 1	7	#15, #16, #17	Prescribed Burn	0.1
7/1/91	1069	PVT	Opie 1	1	Dispatcher 6-Pack	False Alarm	
7/5/91	1067	PVT	Opie 2	1	FMO Engine	False Alarm	
7/5/91	1068	PVT	Thompson	1	Dispatcher 6-Pack	False Alarm	
7/12/91	1040	BLM	Eagle Count M407	3	#17	Equipment Fire	
7/17/91	1213	FWS	Krumbo Dam	6	#16, #17	Prescribed Burn	2
7/24/91	1051	BLM	Borrow Pit M410	6	#16, #17	Standby	
7/31/91	1111	BLM	Spring Creek M415	3	#16	Standby	
8/3/91	1077	BLM	Mud Creek M422	3	#16	Wildfire	0.5
8/3/91	1077	BLM	Mud Creek M422	3	#17	Standby	
8/6-8/7/91	1078	USFS	Sugarloaf P60001	3	#16	Wildfire	2
8/6/91	1078	USFS	Sugarloaf P60001	3	#17	Standby	
8/18/91	1091	BLM	Skull Creek M436	3	#16	Standby	
8/19-8/21/91	1091	BLM	Skull Creek M436	5	#17, 750 Dozer, Trac/Trail. w/low boy	Wildfire	425
8/20/91	1092	BLM	Fir Creek M437	3	#16	Wildfire	0.5
8/20/91	1093	FWS	S. Center	1	Bean Sprayer, BLM Heavy	Wildfire	0.1
8/20-8/21/91	1096	BLM	Weaver Place M447	3	#16	Wildfire	0.1
8/22/91	1102	BLM	N. Skull Creek M451	3	#16	Standby	
8/23/91	1091	BLM	Skull Creek M436	3	#16	Standby	
8/23/91	1110	BLM	False Alarm #7 M454	3	#16	False Alarm	
8/29/91	1214	FWS	Library 2	5	#16, #17	Prescribed Burn	0.1
9/1-9/2/91	1114	BLM	Turner Creek M897	3	#16	Wildfire	8000
9/4-9/5/91	1115	BLM	Big Bridge Creek M456	3	#16	Wildfire	20
9/4/91	1000	FWS	East Grain Camp	1	Bean Sprayer	Wildfire	0.1
9/5/91	1133	BLM	Jackass	5	#15, #17	Wildfire	0.1
9/5/91	1134	BLM	Alkali	5	#15, #17	Wildfire	0.1
9/5/91	1126	BLM	Kern Reservoir M458	2	#17	Standby	
9/5-9/6/91	1126	BLM	Kern Reservoir M458	3	#16	Wildfire	48
9/5-9/6/91	1128	BLM	Sinking Water M457	1	750 Dozer, Trac/Trail. w/low boy	Wildfire	350
9/12/91	1141	FWS	South Field RNA Finley NWR	6	#17, 6-Pack	Prescribed Burn	110
9/13/91	1180	FWS	Field 29 Finley NWR	6	#17, 6-Pack	Prescribed Burn	40
9/13/91	1181	FWS	Field 22 Finley NWR	6	#17, 6-Pack	Prescribed Burn	80
9/13/91	1182	FWS	Field 22 SW Finley NWR	6	#17, 6-Pack	Prescribed Burn	20
9/13/91	1183	FWS	Field 22 NW Finley NWR	6	#17, 6-Pack	Prescribed Burn	30
9/14/91	1137	FWS	North Field RNA Finley NWR	6	#17, 6-Pack	Prescribed Burn	80
9/18/91	1138	BLM	Crane Creek M459	3	#17	Wildfire	100
9/23-9/25/91	1142	FWS	McFadden Finley NWR	3	#17	Wildfire	220
9/26-9/27/91	1177	BLM	Arizona Creek M461	2	#17	Wildfire	100
10/9/91	1215	FWS	Diamond Lane	5	#16, #17, BLM Heavy	Wildfire	0.1
TOTAL	PRESCRIBED BURNS = 14 (1889 AC.)			165	WILDFIRES = 20 (11,030 AC.)		12919

Table XV Prescribed Burns by Malheur Refuge Fire Crews in 1991.

DATE	UNIT	ACRES BURNED	PURPOSE
26 FEB	Jones	345	Remove rank vegetation for cranes & geese; improve crane/goose nesting habitat.
27 FEB	Faye	978	Remove rank vegetation for cranes & geese; improve crane/goose nesting habitat.
3 MAR	P-Ranch	0.5	Weed control; fireproof buildings.
14 MAR	Double-0	203	Remove emergents; enhance waterfowl brood habitat.
15 MAR	Double-0	0.5	Fuel reduction; weed control.
20 JUN	Library 1	0.1	Remove debris from fallen tree.
17 JUL	Krumbo Dam	2	Kill shrubs to prevent root damage to earthen dam.
29 AUG	Library 2	0.1	Remove debris from YCC tree prunings.
		1529.2	Total acres burned on Malheur Refuge.
12 AUG	S. RNA Field	110	Set back seral stage; eliminate shrubs and trees.
13 AUG	Field 29	40	Farm field prep; remove vegetation, provide fertile seed bed.
13 AUG	Field 22	80	Farm field prep; remove vegetation, provide fertile seed bed.
13 AUG	Field 22 SW	20	Farm field prep; remove vegetation, provide fertile seed bed.
13 AUG	Field 22 NW	30	Farm field prep; remove vegetation, provide fertile seed bed.
14 AUG	N. RNA Field	80	Set back seral stage; eliminate shrubs and trees.
		360	Total acres burned on Finley Refuge.
14 Units		1889.2	Total Acres

Ten to twenty small prescribed burns of 20-500 acres each are planned annually for the refuge in the Blitzen Valley and Double "O" management units. Between one and two thousand acres are scheduled for prescribed burning each year. This will be a reduction in the average acreage burned each year, but an increase in the number of fires per year compared to past years. Smaller site-specific burns can accomplish habitat objectives while reducing smoke management concerns and public alarm over large fires lighting the skies at night.



Malheur and Hart Mtn. fire crews burned a dense cattail/tule stand in the Upper Swamp Unit at Double-0 on March 14 to provide this waterfowl brood habitat. JO 6/91

Malheur Refuge burned 8 units totaling 1592 acres in 1991. The Central Patrol Road from Five-Mile to the P-Ranch was closed during the Faye fire on February 27 due to smoke and fire line activities. Fire improved sandhill crane and waterfowl habitat on the larger units and removed brush and debris on the smaller areas.

Prescribed burning at Malheur can be unpredictable at times. The Faye fire on February 27 is an example. Although the fire was within burning parameters at all times, strange things were happening. The forecasted wind was supposed to be coming from the northeast. As the burn was started at 1045 hours the wind was out of the northeast at 0-4 MPH. An hour later it shifted to the southeast and increased to 8 MPH. The rest of the day it shifted back and forth from the northeast to the southeast. The Steens Mountains are believed to have a strong orographic effect on the local winds in the Blitzen Valley,

especially in the south end where burning was occurring. This effect of the local winds should be taken into consideration by not starting a burn until after noon, if it is a sunny day and there is chance of upslope winds developing. On overcast days, or days when the landmass has heated up earlier, the orographic effects should be more stable and predictable. A unit in the south end of the Blitzen Valley is planned for a burn next year on an overcast day to determine if the wind patterns change as drastically. Wind readings should be taken hourly on all burns in the south Blitzen Valley for future reference.

The Faye and Jones Unit prescribed burns provided excellent goose, duck, and shorebird habitat for nesting, loafing, and feeding. Flood irrigating the recently burned fields accelerated green-up and promoted early Canada goose nesting. White pelicans, long-billed dowitchers, western sandpipers, yellowlegs, and other shorebirds also seemed to prefer the flooded meadows in these burned units.



Pelican, ducks, and shorebirds frolicked in the sheet-flooded meadows of Faye field in May following the Feb 27 prescribed burn. RB 5/91

As a result of budget constraints, Malheur Refuge hired only 8 temporary fire employees; two were females. We are remodeling our headquarters fire building is being remodeled to better accommodate a larger crew and whatever male/female mix we get in 1992.

Malheur's fire crew for 1991 consisted of three GS-5 Engine Foremen (Mike Callaway, Dan Browder, and Kim Kelley), four GS-4 Firefighters (Eric Anderson, Mark Makely, Liz Curry, and

Mike Haner), and one dispatcher (Pam Spanos). All attended pertinent sessions of the basic fire training with the Burns BLM fire crews. Anderson, Browder, Callaway, Curry, and Makely qualified as Class II fallers with the chain saw. By mid-August we lost the dispatcher, one foreman, and one firefighter (two fired; one quit).

In addition to their regular fire suppression duties, the fire crew accomplished the following projects in 1990:

1. Fenced Witzel Corral to provide better public access.
2. Designed and built a walk through gate at Barn Springs.
3. Helped carpenter pour concrete at various refuge quarters.
4. Took turns at staffing the BLM/FWS Steens Mt. information kiosk.
5. Cut, hauled, and installed juniper trees for rip-rap on Blitzen River.
6. Set up a more efficient fire cache.
7. Mowed fire lines for prescribed burns.
8. Assisted with trapping and banding mallards and sandhill cranes.
9. Checked fish traps for ODFW.
10. Built 11.25 miles of new 4-strand barbed wire fence. (See Table XVI).

Table XVI. Fence Constructed by 1991 Malheur Fire Crews.

DATE	NAME	LOCATION	LENGTH (MILES)
Jun	NW Harney	N. of 00 Road	3.375
Jul	NE Harney	S. of 00 Road	3.5
Aug	Narrows	N & W of Church's	2.25
Aug	Barn Springs	Frenchglen	0.25
Sep	9-Mile Corral	W. side of 205	0.5
Oct	DeGuire's	Double 0	1.125
Nov	Witzel Corral	E. side of 205	0.25
Total miles			11.25



Table XVII. Prescribed Burns on Malheur Refuge (1982-1991).

YEAR	NO. PRESCRIBED BURNS	AVERAGE SIZE ACRES	TOTAL ACRES BURNED	(LARGEST FIRE)
1982	5	81	405	(200)
1983	5	670	3350	(900)
1984	1	960	960	(960)
1985	4	1493	5973	(5500)
1986	5	494	2470	(1200)
1987	10	373	3729	(1600)
1988	11	280	3074	(1100)
1989	9	224	2015	(600)
1990	5	96	478	(300)
1991	8	191	1529	(978)
	63	381	23,983	



The fire crew used this converted military jeep to replace boundary fence destroyed by flooding in the 1980's along highway 205 near The Narrows. RV 9/91

Refuge and BLM fire crews were stationed together for the first time at Frenchglen this year. Our crew integrated as much as possible with the BLM crews and rotated into their duty schedule. They took turns at initial attack, standby, and yard duty which included facility repairs and maintenance, equipment maintenance, and staffing the Steens Mountain information kiosk. We didn't participate fully in the BLM's on-the-job training when they spent days and days at area

familiarization. BLM fire crews in general spend their time doing suppression activities only. They avoid resource project work. The refuge crew enjoys doing resource project work and takes pride in this part of their job.

Five wildfires burned 813.3 acres on the refuge in 1991. The Knox wildfire started after completion of a prescribed burn on the Faye Unit just south of the 5-Mile Road. Mopping up was in process at the southeast corner of the unit when some willows were noticed burning along the east side of the Blitzen River. The fire had produced several firewhirls which burned across the river and the Center Patrol Road - a distance of 100 feet! They converged in the center of the Knox Unit and developed into a huge firewhirl 50 yards in diameter and 400+ yards high! It sucked in vegetation and fire from around it as it headed east towards the K2 ditch. Back firing was started at the NW corner of the Knox Field and continued south along the K2 ditch. The whirl lost a lot of power going around a pond in the center of the unit, then raced at 30-40 MPH towards the NW corner where black line had been put in next to the K2 ditch. It carried fire through the 12' wide black line, but went out in a loud "whoosh" when it raced over the water in the ditch. The whirlwind continued on the other side of the ditch, but contained no fire. All day long weather readings showed the wind was shifting back and forth from the SE to the NE, but was never stronger than 8 MPH. However, the fire created its' own weather and strong winds with many fire whirls strong enough to shake the ground as they passed by.



Fire whirl beginning to develop in Knox Unit.
Photo taken from NE corner of field at K2 ditch
looking west. RB 2/91



Fire whirl building in size and intensity as it
gets closer to the K2 ditch in the Knox Field.
RB 2/91



Ground shakes and sun is blotted out as fire
hits our black line at the K2 ditch traveling
about 40 MPH! The flames went "whoosh", but
the whirl continued to the north until it lost
strength and left a 10' X 70' row of unburned
tules and cattails in the Jones Field. RB 2/91



Mule deer used the cattail and willow patches which were burned in the Knox field wildfire of Feb 27. RB 11/91

The North Jones wildfire resulted from high winds which fanned hot spots in the peat soils still smoldering from the Feb 26 prescribed burn in the Jones Field. On Feb 28 strong SE winds ignited heavy emergents at the SE corner of the North Jones Field on Malheur Refuge and consumed the west edge of the field to within 200 feet of the West Swamp Field. The wind driven fire was hot and fast moving. It is improbable that any new peat fires were started. Rain started falling on this fire at about 1400 and helped to extinguish it by 1630 hours. About 50 acres were burned in the North Jones Field. Hot embers from the prescribed burn in the South Jones Field on the 26th most likely started this wildfire when high winds developed on the 28th. Blacker and McGowan were able to stop and contain the fire after it burned into a wet area and the flame lengths became less than 4 feet. One small fire remained in a patch of cattails that was surrounded by water and burned fuels.

On Sunday, 3 Mar 91, extremely high winds (which damaged many houses in Burns) started the fire burning again in the North Jones Field. Since the road between Burns and the refuge was closed due to the high winds and multiple vehicle accidents, Nuffer and Gibson monitored the fire from 1530 until 2030 hours. The fire remained in the unit and burned another 100 acres before going out on its own the next morning.

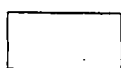
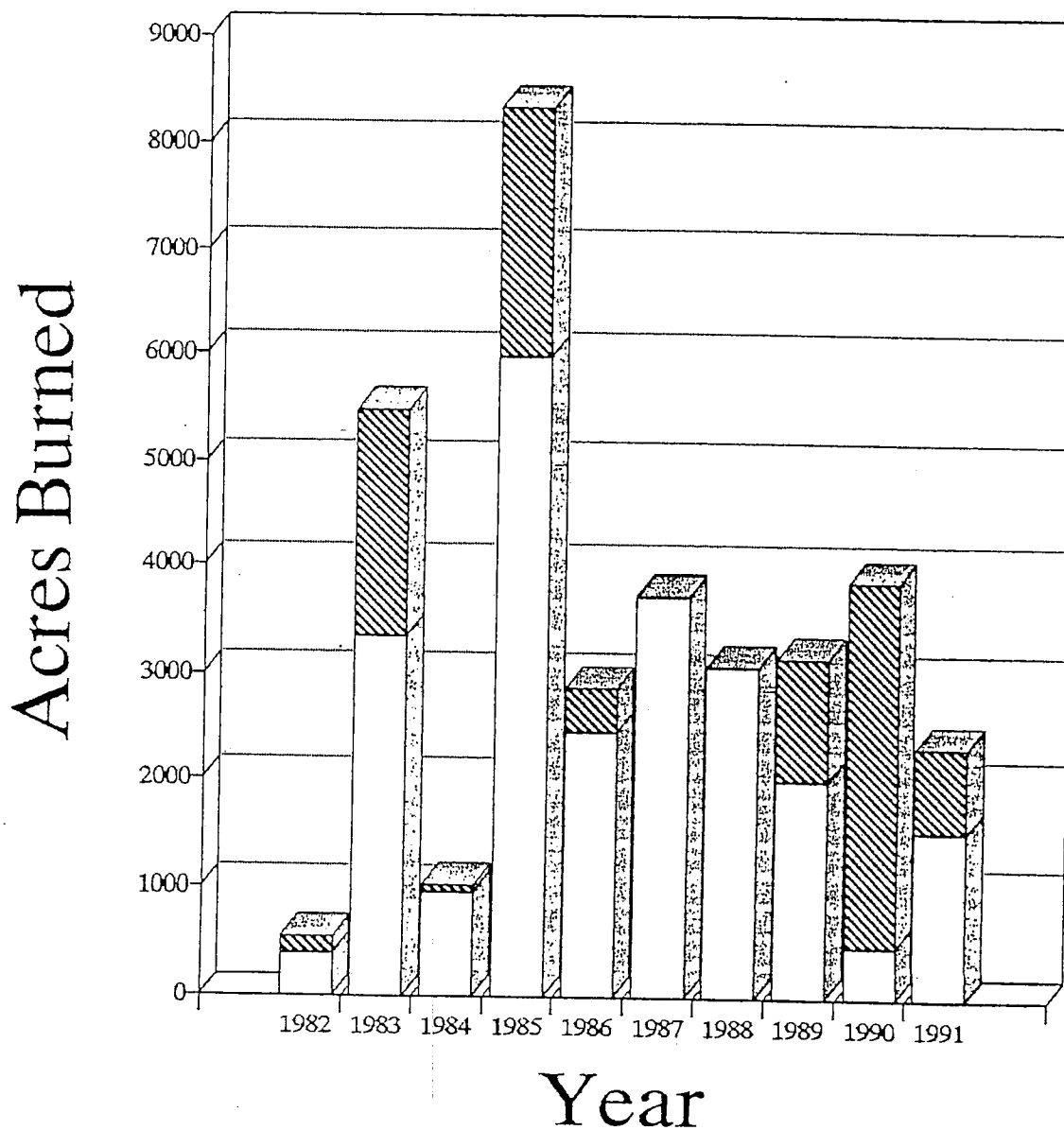
A lightning strike ignited a recently rake-bunched hay pile in the South Center Field on Aug 19. Larry Dunn saw the strike from his farm house about a mile away. He called BLM dispatch and started to dig a hand line around the fire with a shovel. On his way home from the Skull Creek fire Refuge Equipment Operator Marv Jess stopped by to help Mr. Dunn contain the fire until a BLM heavy engine arrived and foamed the burned area. Heavy rain along with the lightning strike kept the fire to a small size until it was extinguished. This was typical of many lightning strikes this summer on and off the refuge.

A hay trailer caught fire on Oct 9 along Diamond Lane. The trailer and hay was lost in the blaze which also burned an area about 50'x110' along the road. Every year one or two of these incidents happen in conjunction with the grazing program on the refuge.



Tractor lost in fire on Highway 205 near Eagle Point. Refuge crews arrived before BLM crews on this fire using closest forces concept. RV 10/91

Malheur Refuge Fires



Prescribed Burns



Wildfires

Table XVIII 1990 Malheur Refuge Wildfires.

DATE	NAME	ACRES BURNED	VEGETATION	CAUSE
26 FEB	Knox	663	Meadow/Marsh	Firewhirl
27 FEB	N. Jones	150	Meadow/Marsh	Peat fire
19 AUG	S. Center	0.1	Meadow	Lightning
4 SEP	E. Grain Camp	0.1	Meadow	Rocket Net
9 OCT	Diamond Lane	0.1	Upland	Hay Wagon
Total acres burned		813.3		

For the past 10 years (Table XIX) the refuge has averaged 3 wildfires, burning 1,054 acres per year, with an average of 340 acres burned per wildfire.

Table XIX Malheur Refuge Wildfires (1982-1991).

YEAR	NUMBER WILDFIRES	AVERAGE SIZE (ACRES)	TOTAL ACRES BURNED	(LARGEST FIRE)
1982	2	82	163	(160)
1983	4	5385	2150	(1570)
1984	2	41	82	(80)
1985	3	785	2354	(1753)
1986	2	213	426	(425)
1987	-	----	----	----
1988	1	.5	.5	(0.5)
1989	8	105	1156	(640)
1990	4	849	3395	(3200)
1991	5	163	813.3	(663)
TOTALS	31	340	10539.8	

10. Pest Control

In an effort to control the infestation of Canada Thistle, two different biological controls, a crown root boring weevil (*Ceutorhynchus litura*) and a stem gall fly (*Urophora cardui*) were introduced to a patch of thistle. Each insect attacks the thistle in a different manner and about 100 individuals of each were released at the site. The crown root boring weevil feeds on the inside of the plant eventually causing a decrease in the number of rhizomes and seed production. The stem gall fly creates a gall on the stem which interferes with plant growth and seed production. Although it is too early to determine the effects on the plants at this time, they will be monitored over the next few years for any changes.

11. Water Rights

Dry conditions continued in the Steens Mountain area until May, so that no private irrigation water could be diverted from Krumbo Creek for the diversion period October 1, 1990 through April 30, 1991. This is because minimum stream flows could not be met as required by the stipulated agreement with Hammond Ranches, Inc. Construction of the diversion from the middle fork to the north fork of Krumbo Creek had not been started by year's end.

Assistant Associate Manager Fred Zeillemaker, Hydrologist Dave Langman (EN), Water Rights Specialist Bob Oser (EN) and Barbara Scott-Brier of the Regional Solicitor's Office met for a week in July with refuge staff for an on-site review of water right issues throughout the refuge. Maps, legal documents and on-site gauging and diversion structures were reviewed. This was the formal beginning of a renewed effort to be carried out over the next few years, to clarify and solidify Malheur's water rights. By year's end the effort had produced computerized maps of the refuge water rights as recorded in the State Department of Water Resources and a plan authored by Hydrologist Langman to design water measuring and monitoring systems. Additionally, approval was gained to recruit an assistant manager, GS-485-11, to deal exclusively with water issues.

15. Private Lands

Five wetlands restoration projects were initiated in 1991, with four on private lands and one on State Land. The Projects are listed below in Table XX.

Table XX Partners For Wildlife Projects, Malheur NWR.

Project Number	Owner	Total Cost	USFWS Percent	Project Description
1991-01	Squaw Butte Exp. Station	\$5,200	29%	Development of 4 acre brood pond. Construction of 1/5 Mile Fence.
1991-02	Tom Clemmens	\$5,734	46%	Development of 2 brood ponds totaling 20 acres.
1991-03	Louis Yriarte	\$1,400	44%	Development of a 6 acre brood pond. Fence Construction of 1/4 mile.
1991-04	John Bauer	\$10,410	46%	Development of 2 brood ponds totaling 3 acres. Fence Construction of 1/4 mile.
1991-05	Charles DeGuire	\$7,737	77%	Development of a 20 acre brood pond. Fence construction totaling 1/2 mile.
TOTAL		\$30,481		

In December, proposals for four additional wetland restoration projects on private lands, totalling approximately 100 acres in Harney and Grant Counties, were submitted for FY 92 funding.

G. WILDLIFE1. Wildlife Diversity

Three new breeding species have been documented on Malheur NWR this year. New refuge accounts include evening grosbeaks (2 immatures and 1 adult) at refuge headquarters on June 25 and 2 black-headed grosbeak nests in the riparian area along the Center Patrol Road near P-Ranch. Blackheaded Grosbeaks were also observed nesting in 1990 by Fish and Wildlife personnel from Fort Collins, CO but were not reported because of their unfamiliarity with its breeding status. A rufous-sided towhee was also observed feeding a fledgling on 20 July, at Barn's Spring near Frenchglen.

A list of unusual birds documented at or near Malheur Refuge during 1991 appear in Table XXI.

Table XXI Unusual Bird Sightings and Dates at Malheur Refuge, Oregon, 1991.

SPECIES	NO.	DATE
Common Loon	1	11 May
Pacific Loon	1	02 Nov.
Horned Grebe*	2	16 May
White-winged Scoter	1	06 & 07 Nov.
Red-shouldered Hawk	1	14 Sep.
Merlin	1	28 Sep., 11 Oct.
Peregrine Falcon	1	08 Aug., 18 & 19 Sep.
Gray Partridge*	6	12 Sep.
Black-bellied Plover	4	08 Aug., 28 Sep., 05 Oct.
Lesser-Golden Plover	1	28 Sep.
Semipalmated Plover	2	22 Aug.
Solitary Sandpiper	4	21 Aug.
Whimbrel	1	25 May
Red Knot*	1	19 May

SPECIES	NO.	DATE
Stilt Sandpiper	1	08 May
Northern Saw-whet Owl	1	03-28 Feb.
Vaux's Swift	1	28 Apr.
Calliope Hummingbird	1	14 May
Rufous Hummingbird	1	15 May
Least Flycatcher*	1	25 May
Cordillera Flycatcher	1	31 May
Clark's Nutcracker*	1	25 Mar.
Blue-gray Gnatcatcher	1	15 May
Brown Thrasher	1	07-26 Apr. & 03 Jun.
Red-eyed Vireo	1	09,12,17 Jun.
Philadelphia Vireo*	1	03 Jun.
Tennessee Warbler*	1	03 Jun.
Chestnut-sided Warbler	1	09 Jun.
Cape May Warbler	1	01 Jun.
Ovenbird	1	27 May & 03-05 Jun.
Northern Waterthrush	1	28 May & 04 Jun.
Rose-breasted Grosbeak	1	06 Jun.
Indigo Bunting	1	28 May
Harris' Sparrow	1	10-16 Dec.
Scott's Oriole*	1	04 Jun.
Orchard Oriole*	1	05-08 Jun.

* denotes birds observed adjacent to the refuge

Mountain lions were observed on the refuge at two different locations. They are known to inhabit higher elevation sites surrounding the refuge, including the Steens Mountains, but it is unusual to observe them at lower elevations, especially during the summer.



A Pacific Loon, only the fourth to be seen at Malheur Refuge was observed on November 2, 1991. The same bird was found dead 2 months later, the victim of a hit and run on the Double "O" road. RTV

2. Endangered and/or Threatened Species

Peregrine falcons have been observed for the past five years and two sightings were reported on Malheur Refuge this year. These sightings are probably related to recent increases of breeding pairs in Oregon.

The refuge staff again participated in winter bald eagle roost counts. The counts are a multi-agency effort to document winter bald eagle numbers in Harney basin. This year the data indicate a record peak of 263 bald eagles on March 18 and 19 compared to 142 eagles last year. A previous record of 212 was set in March 1987.

3. Waterfowl

Midwinter Census

The midwinter waterfowl survey revealed 2959 Canada geese, one snow goose, 26 trumpeter swans, and 479 ducks using the refuge. Duck and goose numbers were about half 1990 levels. These low numbers were due to sub-zero temperatures in late December which convinced most birds to leave the area. Very dry fall conditions also left little green browse for geese.

Spring Waterfowl Migration

Spring migration began in February with the arrival of northern pintails, tundra swans, and snow geese. Peak numbers and dates for selected spring migrants appear in Table XXII.

Table XXII Estimated Spring Migration Waterfowl Peaks, Malheur Refuge, 1991.

SPECIES	NUMBER	MONTH
American Wigeon	2,204	April
Green-winged Teal	7,453	March
Mallard	5,178	May
Pintail	11,069	April
Northern Shoveler	11,173	April
Ruddy Duck	3,013	April
Canvasback	671	April
Canada Goose	8,918	April
Snow Goose	2,253	April
Tundra Swan	979	March

Table XXIII summarizes spring waterfowl use-days for ducks, geese and swans. Total spring duck use on the refuge was down substantially from last year, while goose and tundra swan use increased.

Table XXIII Spring Waterfowl Use-Days (February 1 - May 31) for Malheur Refuge, 1985-91.

SPECIES	Use-Days in Thousands					
	1986	1987	1988	1989	1990	1991
Tundra Swan	43.0	11.0	12.5	57.2	19.6	30.2
Trumpeter Swan	3.4	5.7	4.9	1.2	1.8	1.1
Geese	285.0	958.0	265.8	1,786.1	274.0	564.6
Ducks	2,088.0	1,623.6	1,330.2	2,444.3	4,145.9	2,680.4
TOTALS:	2,419.4	2,598.3	1,613.4	4,288.8	4,441.3	3,276.3

Duck and Coot Breeding Population

Overall, 1991 duck pair numbers totalled 11,090, and were up one percent from 1990. Mallards, pintails, green-winged teal,

cinnamon teal, shovelers, redheads and common mergansers were observed in increased numbers in 1991. Gadwalls showed the most significant decline from 1990 numbers, while other duck species showed slight declines. Coot pair numbers showed a 53 percent increase from 1990 levels. Estimated breeding pair numbers are summarized in Table XXIV.

Table XXIV Estimated Duck and Coot Breeding Pairs, Malheur Refuge, 1988-91.

SPECIES	YEAR				PERCENT CHANGE FROM 1990
	1988	1989	1990	1991	
Mallard	2284	1829	2203	2589	+ 15 %
Gadwall	1637	1941	2969	1990	+ 33 %
Northern Pintail	267	608	210	387	+ 84 %
Green-winged Teal	113	105	53	19	- 64 %
B.W./Cin. Teal	3884	3440	3006	3041	+ 1 %
American Wigeon	248	171	251	208	- 17 %
Northern Shoveler	528	1035	480	1020	- 113 %
Dabbler Subtotal	8961	9129	9172	9254	+ 1 %
Redhead	993	2422	1067	1361	+ 28 %
Canvasback	115	319	190	164	- 14 %
Lesser Scaup	104	64	101	17	- 83 %
Ring-necked Duck	11	5	5	251	+ 4920 %
Ruddy Duck	404	407	405	7	- 98 %
Common Merganser	18	8	0	36	+(zero in 1990)
Diver Subtotal	1660	3225	1768	1836	+ 4 %
TOTAL DUCK PAIRS	10621	12354	10940	11090	+ 1 %
American Coot	2656	3051	2133	3264	+ 53 %

The P-Ranch Unit (Unit 12) supported the highest duck pair numbers, followed by the Sodhouse Unit (Unit 7), the Buena Vista Unit (Unit 8), and the Double-O (Unit 1). Malheur Lake Units 4,5 and 6 showed the greatest increase when compared to the 1990 pair numbers. This was probably due to improved habitat in the lake as lower levels facilitated carp elimination, from freezing in winter ice, at many of the isolated shallow ponds around the lake.

Duck Production

Since 1988, duck production estimates have included a factor for brood survival (see 1988 Narrative report for details). Duck production estimates for 1991 totalled 5431, compared to 10105 in 1990, 8073 in 1989, and 4100 in 1988. Productivity, expressed as ducks produced per pair was .49 in 1991, compared to .92 in 1990, .65 in 1989 and .40 in 1988. The most important factor causing the reduced production appeared to be poor nest success, which was diminished by extensive flooding in the Blitzen Valley.

Canada Goose Production

Estimated breeding pairs of Canada geese this year was 1012, barely below the estimated 1019 in 1990. The population has shown an increasing trend since its decline during the years of severe flooding of Malheur Lake. Nest success for Canada geese ranged from 12 percent on Malheur, Mud and Harney lakes, to 54 percent in the upper Blitzen Valley.

Goose production for 1991 was 1213, a decrease of 41% from 1990 (2025), and 40% less than the 10 year average (1980-1989) of 1836. Overall population estimates for 1991 decreased by 1026 geese or 33% from 1990. This decrease was apparently due to early abandonment of the refuge by both breeding and non-breeding geese as a result of extremely dry conditions in the area which caused a reduction of breeding habitat available in the early spring.

Trumpeter Swan Production

Fourteen Trumpeter Swans were produced on Malheur Refuge in 1991, 3.3 greater than the previous ten-year average. Average brood size was 2.3, slightly above average. Six pairs nested this year and all were successful in raising broods. Nests were located at Darnell, Cottonwood, Jones, Benson, East Buena Vista, and Unit 8 ponds. The only brood losses documented were two cygnets which disappeared from a brood of three at the Unit 8 Pond.

The spring count for the population showed only 20 white swans in the area. Two subadults were captured and moved in late July to Summer Lake Wildlife Area. The fall (early October) trumpeter count showed 20 swans total. Table XXV summarizes historic swan production data for the population.

Table XXV Summary of Trumpeter Swan Production in Eastern Oregon, 1958-1991.

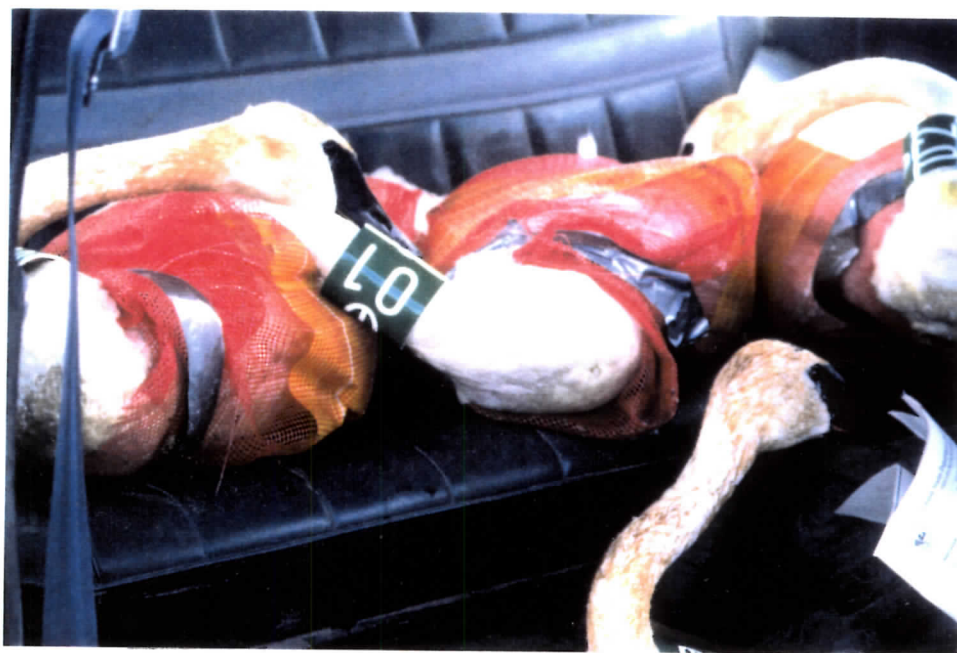
YEAR	YOUNG PRODUCED	MEAN BROOD SIZE AT FLEDGE (ACTUAL SIZES)	NUMBER OF SUCCESSFUL BROODS
1958	4	2.0	2
1959	0	0.0	0
1960	14	2.8 (5,3,3,2,1)	5
1961	0	0.0	0
1962	3	1.5 (2,1)	2
1963	17	3.4	5
1964	6	2.0	3
1965	11	2.8 (5,3,2,1)	4
1966	12	3.0 (5,3,3,1)	4
1967	12	4.0 (6,4,2)	3
1968	11	2.2 (4,2,2,2,1)	5
1969	14	3.5 (5,4,4,1)	4
1970	13	3.3 (4,4,3,2)	4
1971	22	3.6 (5,4,4,4,3,2)	6
1972	13	2.6 (3,3,3,2,2)	5
1973	4	4.0 (4)	1
1974	9	3.0 (5,2,2)	3
1975	7	2.3 (4,2,1)	3
1976	8	4.0 (4,4)	2
1977	0	0.0	0
1978	13	2.6 (4,3,2,2,2)	5
1979	33	3.3 (6,5,5,4,3,3,2,1,1)	10
1980	15	2.1 (4,4,2,2,1,1,1)	7
1981	9	3.0 (3,3,3)	3
1982	17	2.8 (6,3,3,3,1,1)	6
1983	17	2.8 (5,4,3,2,1,1)	6
1984	6	3.0 (3,3)	2
1985	2	1.0 (1,1)	2
1986	24	3.4 (6,6,3,3,3,2,1)	7
1987	14	2.3 (4,4,3,1,1,1)	6
1988	8	2.0 (3,2,2,1)	4
1989	3	1.5 (2,1)	2
1990	7	3.5 (5,2)	2
1991	14	2.3 (5,3,2,2,1,1)	6
	362	2.8 average	129



Trumpeter swan production was good this year,
with 14 cygnets reaching flight stage. GI 6/91



Ivey, Vetter and Brown packing two subadult trumpeter swans for
transport to Summer Lake Wildlife Area. SF 7/91



Four Trumpeter swans, packed and in transit to Malheur from Red Rock Lakes Refuge. They forgot to fasten their seatbelts. SF 7/91

Fall Waterfowl Migration

Compared to recent years, fall waterfowl migration was impressive in 1991 (Table XXVI). Overall waterfowl use was high. Goose use almost doubled from 1990, and duck use increased by a factor of six. Table XXVII lists 1991 waterfowl peaks on the refuge. The increased duck use was primarily due to the appearance this year of extensive aquatic plant beds in Harney Lake, which supported over 90 percent of the refuge duck use.

Table XXVI Fall Waterfowl Use-Days (Sept. 1-Dec. 1) on Malheur Refuge, 1986-91.

SPECIES	Use-days in Thousands					
	1986	1987	1988	1989	1990	1991
Tundra Swan	55.0	4.7	6.9	10.6	21.4	18.4
Trumpeter Swan	3.9	7.4	6.2	1.2	2.5	3.1
Geese	446.0	440.0	513.6	541.7	466.5	749.3
Ducks	1,916.0	1,743.0	1,859.8	1,687.8	1,694.8	10,032.8
TOTAL:	2,756.6	2,420.9	2,195.1	2,241.3	1,285.	10,803.6

Table XXVII Estimated Fall Waterfowl Peaks on Malheur Refuge, 1991.

SPECIES	1991		RECENT FALL PEAKS	
	NUMBER	PERIOD	NUMBER	YEAR
Mallard	20,820	November	31,230	1980
American Wigeon	22,083	October	21,440	1979
Northern Shoveler	5,395	October	22,580	1979
Green-winged Teal	38,606	November	17,750	1982
Canvasback	1,819	November	20,950	1979
Redhead	29,453	September	17,700	1979
Canada Goose	16,323	November	10,625	1983
Snow Goose	1,000	November	8,000	1979
Tundra Swan	541	November	31,230	1980

4. Marsh and Waterbirds

Coot Production

Estimated coot production was 7,441, 48% higher than in 1990; however, this figure does not account for brood survival.

Colonial Nesting Waterbirds

Nesting colonial waterbirds were censused cooperatively with the Oregon Department of Fish and Wildlife on the refuge and elsewhere in Harney County. This year's colonial waterbird surveys included a helicopter flight, courtesy of the Oregon Department of Fish & Wildlife, supplemented by fixed-wing aircraft flights and ground visits to some of the colonies during the breeding season.

Colonial waterbird production, for most species, in 1991, was lower than in 1990. The only species which showed significantly increased production this year were white-faced ibises and Franklin's gulls. Only six active colonies were located and censused in the Harney Basin. Seven 1990 colonies were inactive primarily as a result of lack of water because of drought conditions. Some colony sites were not used because declining levels at Malheur Lake linked these sites with the shore. One new colony containing eight cormorant nests appeared on Cole Island Dike, northeast Malheur Lake.

In 1990, three Malheur Lake islands were used by nesting pelicans. All three islands were joined to the shore of the lake in 1991 as water levels have continued to decline. Consequently, no pelicans nested in the Harney Basin in 1991. Even with the lower lake

levels, a few remaining islands appeared suitable for pelican nesting, however, the birds didn't get the idea this year.

Generally, the number of breeding pairs (Table XXVIII) of most colonial waterbirds in the Harney Basin decreased in 1991. Exceptions included white-faced ibises and snowy egrets. Ibis pair numbers were the second highest on record. No cattle egrets were found nesting in the area in 1991.

Table XXVIII An Estimate of Nesting Pairs of Key Colonial Birds using the Malheur-Harney Lakes Basin, 1966-91.

YEAR	DOUBLE- CRESTED CORMORANT	GREAT BLUE HERON	BLACK- CROWNED NIGHT-HERON	GREAT EGRET	SNOWY EGRET	WHITE FACED IBIS	FRANK- LIN'S GULL
1966	125	200	600	400	50	10	250
1967	50	125	250	200	60	15	250
1968	50	100	500	400	150	20	250
1969	45	110	500	400	150	20	250
1970	50	100	500	180	55	25	500
1971	45	110	750	150	35	20	600
1972	70	150	750	285	80	25	500
1973	85	200	775	230	125	55	1000
1974	75	200	1000	350	140	80	1000
1975	60	210	360	100	55	40	0
1976	40	190	400	200	80	25	200
1977	70	200	375	125	50	110	10
1978	20	40	525	400	135	190	520
1979	80	205	730	415	40	150	1100
1980	180	320	320	200	140	600	1250
1981	235	320	270	170	115	650	1330
1982	360	472	700	550	175	900	900
1983	330	448	745	755	100	420	150
1984	829	572	245	545	141	910	450
1985	739	531	379	562	227	1420	200
1986	982	682	493	631	113	2095	520
1987	1120	568	235	290	89	2475	1010
1988	665	682	45	36	18	2840	725
1989	849	494	315	675	35	4110	225
1990	968	202	187	250	30	2910	360
1991	150	76	64	172	31	3415	550

Table XXVIII Continued

YEAR	WHITE PELICAN	CASPIAN TERN	CALIFORNIA GULL	RING-BILLED GULL	CATTLE EGRETS
1966	0	0	no data	no data	0
1967	0	0			0
1968	0	0			0
1969	0	0			0
1970	0	0			0
1971	0	0			0
1972	0	0			0
1973	0	0			0
1974	0	0			0
1975	0	0			0
1976	0	0			0
1977	0	0			0
1978	0	0			0
1979	0	0			0
1980	0	0			0
1981	0	0			0
1982	0	0			0
1983	0	3	400	25	0
1984	0	350	600	150	2
1985	3	350	520	550	2
1986	150	400	670	580	6
1987	578	150	705	175	0
1988	2045	80	50	500	0
1989	1515	0	0	1050	0
1990	920	25	400	0	0
1991	0	0	0	0	0

Production estimates for colonial waterbirds are summarized in Table XXIX. Most species had a fair production year with decreases in production from 1989.

No eared or western grebe colonies were located on the refuge in 1991. Once again emergents were not available for grebe nesting on Malheur, Mud, or Harney Lakes.

Table XXIX Colonial-Nesting Waterbird Production Summary,
Malheur Refuge and Harney Basin, 1991.

SPECIES	# PRODUCED ON REFUGE	# PRODUCED OFF-REFUGE	TOTAL
American Pelican	0	0	0
Double-crested Cormorant	189	0	189
Great Blue Heron	38	2	40
Black-crowned Night-Heron	135	4	139
Great Egret	150	15	165
Snowy Egret	42	14	56
White-faced Ibis	7684	0	7684
Franklin's Gull	722	0	722
California Gull	0	0	0
Caspian Tern	0	0	0

GREATER SANDHILL CRANES

Sandhill crane pairs were tallied while they were on their territories during the spring. A total of 214 crane pairs on territory were tallied for the refuge in 1991. This represents an increase of 37 pairs over 1990 numbers. These new recruits are a result of our effort to reduce predator impacts on crane production. (See Section G15) Table XXX summarizes numbers of active crane territories by biological unit.

A total of 35 new territories were identified this year. Nine territories recorded as inactive in 1990 were found to be occupied this year, and seven territories which had been active in 1990 were inactive this year. These losses and gains in territory activity can be attributed to shifting of territory sites, pair mortality, and recruitment of new pairs.

Table XXX Number of Sandhill Crane Pairs Found on Territories in 1991
at Malheur Refuge by Biological Unit.

	Biological Unit								
	1	4-5-6	7	8	9	10	11	12	TOTAL
Number of territories	30	5	23	30	24	11	34	57	214

A total of 77 crane nests were located in 1991. Table XXXI summarizes nest fate data for crane nests monitored on the refuge since 1966. Overall nesting success was 50 percent in 1991. This is the poorest hatch since the predator control program began in 1986. Predation accounted for 25 percent of nest losses, while flooding and infertile or rotten eggs accounted for 12 and 13 percent, respectively. Although predation accounted for loss of 25 percent of the nests, many of the nests recorded as predated were probably flooded and/or abandoned in May because of cool, wet weather and then predated. This poor weather caused flooding of several nests in the Blitzen Valley, and apparently killed embryos in some eggs. Several pairs were observed sitting on eggs containing dead embryos.

Crane colts were counted from the air on September 4th in the Double-O and Blitzen Valley using APHIS'Husky aircraft. This aerial data was supplemented with ground counts in the Blitzen Valley. Using a combination of ground and aerial count data, a total of 15 colts were produced on the refuge in 1991. One colt was recorded in the Double-O, one from Malheur Lake, and the remainder from the Blitzen Valley.

Assuming all 214 refuge crane pairs nested, and with 50 percent nesting success, an estimated 107 nests hatched. Using an average clutch size of 1.92, an estimated 205 colts hatched. With 15 crane colts fledging, estimated brood survival was 7.4 percent. Conversely, mortality was 92.6 percent. This brood survival rate is well below the predator control plan goal of 25 percent.

We conducted a telemetry study of crane colt mortality this year (see Section G5). Data from this first year of the study showed mortality to be 93.3 percent (one out of 15 fledged). This rate is very close to the mortality rate suggested by the other refuge data above. Predation was the most important factor in colt losses during the study, with mink as the most important predator.

Crane recruitment for Malheur Refuge has been calculated via the following formula:

$$\frac{\text{Number of colts which fledged}}{\text{Number of nesting pairs} \times 2 + \text{young}} = \text{Recruitment rate.}$$

Therefore, recruitment for 1991 is calculated as follows:

$$\frac{15}{(214 \times 2) + 15} = \frac{15}{443} = 3.4 \%$$

Table XXXI Nest fates of Greater Sandhill Crane Nests Monitored on Malheur Refuge, Oregon; 1966-1991 (Percentages in Parentheses).

Year	NEST STATUS									
	Sample Size	Hatched	Abandoned	Flooded	Infertile	Predated	Raven	Raccoon	Coyote	Unknown
1966	51	18 (35)	7 (14)	0	0	26 (51)	9	6	4	7
1967	59	25 (42)	1 (2)	0	0	33 (56)	13	14	--	6
1969	88	52 (59)	3 (3)	1 (1)	0	32 (36)	10	12	1	9
1970	86	44 (45)	4 (5)	0	0	38 (50)	17	9	1	11
1971	83	44 (53)	0	0	0	39 (47)	16	10	1	12
1973	49	10 (20)	1 (2)	0	1 (2)	37 (76)	20	4	5	8
1974	50	18 (36)	2 (4)	0	0	30 (60)	14	2	7	7
1976	52	35 (67)	0	0	1 (2)	16 (31)	4	6	0	6
1977	50	23 (46)	0	0	1 (2)	26 (52)	9	6	3	8
1978	55	19 (34)	1 (2)	10 (18)	1 (2)	24 (44)	7	5	5	7
1980	30	16 (53)	1 (3)	2 (7)	0	11 (37)	4	2	1	4
1981	31	15 (48)	0	0	2 (7)	14 (45)	5	2	0	7
1982	81	54 (67)	2 (2)	0	1 (1)	24 (30)	8	2	3	11
1983	60	38 (63)	3 (5)	3 (5)	1 (2)	15 (25)	2	5	5	4
1984	67	23 (34)	2 (3)	5 (7)	3 (5)	34 (51)	8	5	8	13
1985	50	24 (48)	1 (2)	0	0	25 (50)	7	1	0	17
1986	60	40 (67)	2 (3)	0	2 (3)	16 (27)	2	2	1	11
1987	61	35 (57)	2 (3)	0	3 (5)	21 (34)	4	4	0	13
1988	67	51 (76)	3 (5)	0	1 (1)	12 (18)	4	1	0	7
1989	70	43 (61)	2 (3)	0	2 (3)	23 (33)	9	4	3	7
1990	60	50 (83)	4 (7)	0	1 (2)	5 (8)	2	2	0	1
1991	77	39 (50)	0	9 (12)	10 (13)	19 (25)	1	0	4	14
TOTAL:1337		716 (54)	40 (3)	30 (2)	30 (2)	520 (39)	175 (13)	104 (8)	51 (4)	190 (14)

Table XXXII summarizes crane recruitment estimates and colts fledged per 100 pairs for the refuge since 1970.

Low productivity this year is believed to be primarily due to poor weather and poor colt survival, however, another factor which may have affected productivity is the inexperience of new young crane pairs. According to C.D. Littlefield (personal communication), young crane pairs are generally unproductive for the first few years of attempted breeding and must learn to become good parents to successfully raise young.

Table XXXII Estimated Recruitment Rates for Greater Sandhill Cranes Nesting on Malheur Refuge; 1970-1991.

Year	Number Young Fledged	Percent Recruitment	Colts/100 pairs
1970	68	12.5	28.9
1971	46	8.9	19.6
1972	43	8.3	18.3
1973	2	0.4	0.8
1974	2	0.4	0.8
1975	17	3.5	7.2
1976	47	9.1	19.9
1977	27	5.8	11.4
1978	43	8.9	19.6
1979	39	8.1	17.8
1980	34	7.1	15.5
1981	23	5.0	10.5
1982	25	5.5	11.7
1983	39	8.4	18.2
1984	8	1.8	3.7
1985	9	2.4	4.8
1986	50	12.1	27.6
1987	43	10.6	23.7
*1988	6	2.1	3.3
1989	49	12.7	29.1
*1990	22	5.8	12.4
1991	15	3.4	7.0

* dry years, cranes migrated early, therefore counts should be considered low.

Sandhill crane use was very high during the fall of 1991 at Malheur Refuge, compared to recent years (Table XXXIII). Peak use occurred in mid October, when a total of 2899 cranes were counted. Large numbers of migrants used refuge grain fields

through early November and most cranes departed by November 15.

Total fall use-days were at the fourth highest level since cranes were first counted in 1973. The main reason for the improvement in use was because we contract-farmed 250 acres of barley in three fields. In recent years, grain was farmed on a cooperative basis using an 80%:20% split and with poor farming methods and poorer irrigation practices the refuge's 20% of 1200 acres seldom left much for the cranes. This year, the yield was excellent and all of it was for the birds.

Table XXXIII Greater Sandhill Crane Fall Use-Days on Malheur Refuge, Oregon, 1973-90.

YEAR	CRANE FALL USE-DAYS
1973	44,916
1974	31,043
1975	118,569
1976	70,401
1977	176,769
1978	104,302
1979	161,537
1980	101,209
1981	89,445
1982	143,566
1983	64,884
1984	95,309
1985	53,354
1986	34,075
1987	40,834
1988	12,163
1989	43,819
1990	20,840
1991	123,535

5. Shorebirds, Gulls, Terns, and Allied Species

Refuge biologists again participated in the Pacific Flyway Project. This project entails spring and fall shorebird surveys of all major coastal and inland shorebird staging areas. The survey was coordinated by biologists from Point Reyes Bird Observatory. During the spring count in late April, Malheur, Mud, Harney, and Stinking lakes were censused.

A total of 4,133 shorebirds were counted. The only unusual species found during the spring count was the black-bellied plover, with a total of 22 observed.

The fall shorebird count was conducted in late August on the same four lakes. A total of 17,284 shorebirds were counted. Unusual observations included one black-bellied plover, two semi-palmated plovers, four solitary sandpipers, six marbled godwits, 95 Baird's sandpipers, and one pectoral sandpiper.

Snowy plovers were counted on the refuge and surrounding habitats in June. A total of 69 adults and six juveniles were recorded. This is the highest count since the early 1980's when most of the snowy plover habitat was eliminated by high water levels in the Basin.

Franklin's gull pair numbers were up from 1990 levels. They nested in a large mixed colony in the Diamond Swamp. In early May, about 600 pairs of California and ring-billed gulls were present in the Bathouse Island Colony on Malheur Lake, however, there was no evidence that they attempted to breed. Caspian tern colonies were not found this year in the area.

6. Raptors

Quarterly Raptor Counts

The refuge continued to participate in cooperative raptor surveys with the Oregon Department of Fish and Wildlife. Other cooperators include the Forest Service, BLM and Oregon State University (Squaw Butte Experiment Station). Data were collected from 15 different survey routes in the Harney Basin. Table XXXIV summarizes raptor counts from 1989 to 1991.

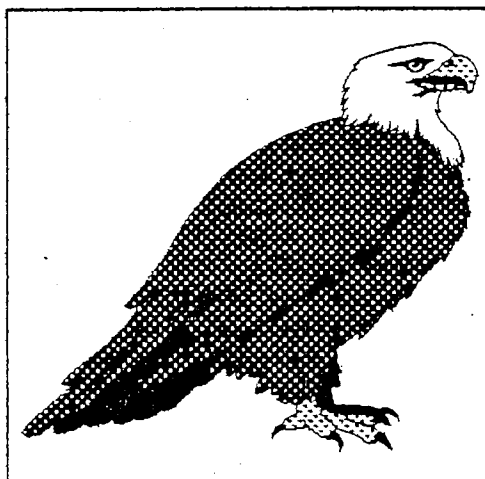


Table XXXIV Annual Summary of Raptors Observed on Quarterly Counts in 1989-1991.

RAPTOR SPECIES	WINTER			SPRING			SUMMER			FALL		
	89--90--91			89--90--91			89--90--91			89--90--91		
Prairie Falcon	6	2	4	2	0	1	1	3	1	1	3	1
Gyr Falcon	0	0	0	0	0	0	0	0	0	0	0	0
Peregrine Falcon	0	0	0	0	0	0	0	0	0	0	0	0
Merlin	0	0	0	0	0	0	0	0	0	0	0	0
American Kestrel	1	3	3	26	3	10	5	13	0	44	39	10
Ferruginous Hawk	0	2	0	7	1	2	3	2	0	10	7	1
Red-tailed Hawk	9	15	3	62	4	11	41	29	9	21	86	25
Rough-legged Hawk	5	60	17	4	3	0	0	0	0	10	0	10
Swainson's Hawk	0	0	0	11	0	1	10	15	3	9	29	5
Unidentified Buteo	8	13	1	13	6	3	4	16	0	14	11	0
Goshawk	1	0	0	0	0	0	0	0	0	0	0	0
Cooper's Hawk	0	0	0	0	0	0	0	0	0	0	0	0
Sharp-shinned Hawk	0	0	0	0	0	0	0	0	0	0	5	0
Northern Harrier	7	25	16	15	43	77	12	26	9	26	23	10
Golden Eagle	2	4	5	6	3	8	4	6	2	4	11	7
Bald Eagle	15	28	3	2	0	0	0	0	0	0	0	0
Osprey	0	0	0	0	0	0	0	0	0	0	0	0
Turkey Vulture	0	1	0	27	17	17	58	49	8	60	86	68
Common Raven	106	126	21	110	21	18	64	82	33	22	94	56
American Crow	0	5	0	18	2	8	96	12	3	0	55	67
Black-billed magpie	7	11	14	3	0	10	2	7	1	4	10	0
Loggerhead Shrike	1	2	1	2	2	5	2	2	4	0	8	7
Northern Shrike	2	1	2	0	0	0	2	1	0	1	0	0
Unknown Shrike	0	0	2	0	0	0	0	0	0	2	0	0
Burrowing Owl	0	0	0	0	0	0	0	1	0	2	0	0
Short-eared Owl	0	0	0	0	0	0	2	2	0	0	0	0
Great Horned Owl	1	1	1	1	0	1	0	1	0	0	0	0
Great Gray Owl	0	0	0	1	0	0	0	0	0	0	0	0

Golden Eagles

Golden eagle nests in the vicinity of the refuge were again monitored 1991. Of the 30 eagle territories monitored, 22 (73 percent) were active as indicated by the presence of adult birds in the immediate area. Eighteen (90 percent) of these nests were successful in fledging at least one young bird. These 18 nests produced a total of 27 young for an average of 1.5 young per nest. This information, along with that compiled since 1966 is summarized in Table XXXV.

Table XXXV Golden Eagle Breeding Data 1940-91, on and Adjacent to Malheur Refuge (Sample Size in Parentheses).

Year Occupied	No. Fledged Per Breeding Territory		No. Fledged Per Successful Nest		Successful Nests	
					Total No. Fledged	No. of Breeding Territories Checked
1940	0.86	(n=7)	1.50	(n=4)	6	57% (n=7)
1966	1.00	(n=6)	1.50	(n=4)	6	57% (n=7)
1967	1.40	(n=10)	1.75	(n=8)	14	73% (n=11)
1968	1.60	(n=5)	2.00	(n=4)	8	57% (n=7)
1969	1.67	(n=6)	1.67	(n=6)	10	66% (n=9)
1970	1.00	(n=8)	1.60	(n=5)	8	45% (n=11)
1971	0.89	(n=9)	2.00	(n=4)	8	40% (n=10)
1972	0.50	(n=10)	1.67	(n=3)	5	27% (n=11)
1973	0.20	(n=10)	2.00	(n=1)	2	8% (n=13)
1974	0.55	(n=11)	2.00	(n=3)	6	25% (n=12)
1975	--	--	--	--	--	--
1976	1.00	(n=8)	1.60	(n=5)	8	55% (n=9)
1977	1.50	(n=8)	2.00	(n=6)	12	60% (n=10)
1978	1.62	(n=13)	1.75	(n=12)	21	75% (n=16)
1979	1.06	(n=16)	1.42	(n=12)	17	71% (n=17)
1980	1.39	(n=18)	1.67	(n=15)	25	83% (n=18)
1981	1.20	(n=18)	1.38	(n=13)	18	72% (n=18)
1982	0.50	(n=22)	1.57	(n=7)	11	32% (n=22)
1983	0.14	(n=21)	1.50	(n=2)	3	9% (n=22)
1984	0.50	(n=28)	1.40	(n=10)	14	36% (n=28)
1985	0.16	(n=28)	1.17	(n=4)	5	14% (n=28)
1986	0.25	(n=24)	1.50	(n=4)	6	17% (n=24)
1987	0.57	(n=30)	1.42	(n=12)	17	40% (n=30)
1988	1.10	(n=30)	1.65	(n=20)	33	67% (n=30)
1989	0.83	(n=30)	1.39	(n=18)	25	60% (n=30)
1990	0.77	(n=30)	1.53	(n=15)	23	50% (n=30)
1991	0.90	(n=30)	1.50	(n=18)	27	60% (n=30)
Pooled Mean	0.90	(n=436)	1.62	(n=215)	338	48% (n=460)

7. Other migratory Birds

Bobolinks

Bobolink surveys were conducted in mid June with a total of 206 males being observed. This number is up substantially from 1990 (98), and represents birds in new areas that were surveyed for the first time this year. Starting in 1992 additional transects will be conducted in these areas to monitor populations. Table XXXVI, provides a summary of male bobolinks recorded from survey transects conducted in 1991.

Table XXXVI Summary of Male Bobolinks by Refuge Field on Malheur Refuge in 1991.

Field (Unit #)	No. Bobolinks	Field (Unit #)	No. Bobolinks
Horse Pasture (7)	11	North Meadow (12)	21
North Meadow (7)	6	W-South Meadow (12)	12
North Jones (11)	11	E-South Meadow (12)	37
South Jones (11)	7	Dry (12)	1
Faye (12)	7	Warm Springs (12)	7
Baker (12)	12	Barley (12)	12
Island (12)	42	E-Big Juniper (12)	5
Bridge Creek (12)	7	W-Big Juniper (12)	8
OVERALL TOTAL	- 206		

Christmas Bird Counts

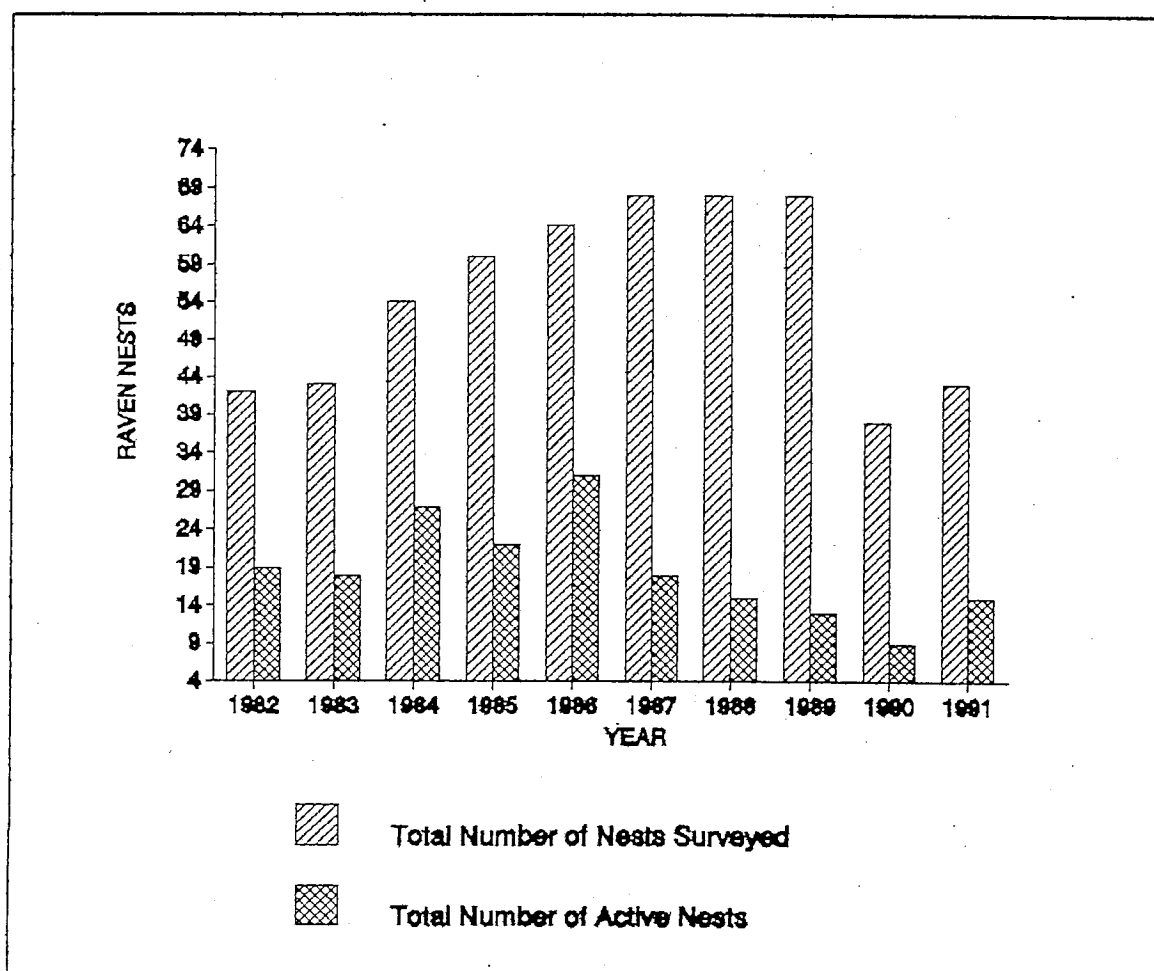
Two Christmas Bird Counts were conducted on the refuge on December 14th and 16th. Highlights of the P-Ranch Count on December 14 include: one Coopers hawk, 2 northern goshawks, one prairie falcon, three Virginia rails, one mourning dove, one short-eared owl, one chipping sparrow, one fox sparrow and one western flycatcher. A total of 63 species were counted. Highlights of the Sodhouse Count on December 16 included: one golden-crowned sparrow, one Harris' sparrow, three sage sparrows, and four Virginia rails the day after the count.

Raven Nesting

Common raven nests are monitored at Malheur Refuge to provide baseline data on the status of the species and to gather information that is useful in evaluating the effects of raven control. Ravens have been identified as key egg predators on greater sandhill cranes, Canada geese, and other waterfowl on

the refuge. Rick Vetter and Sandy Rule conducted raven nest surveys between April 10 and May 21 and monitored a total of 43 nests. Of these, 15 were active and only 1 of these was located within the designated predator control area on the refuge. During 1990, 38 nests were monitored and 9 were active. Four of these were located within the control area. A comparison between these two years indicates a 75 percent decrease in the controlled area and a 60 percent increase in the non-controlled areas. The data suggests that ravens are moving out of the controlled areas or off the refuge to avoid the predator control program. Figure III summarizes raven nest activity on and adjacent to Malheur Refuge.

Figure III Active Raven Nests on Malheur Refuge from 1982-1991.



8. Game Mammals

According to the Oregon Department of Fish and Wildlife, big game species on the refuge and adjacent public lands benefitted from another mild winter and most populations remained at 1990 levels. Mule deer populations stabilized after a 20% increase in 1990 as did pronghorn antelope populations after increasing for 3 years.

10. Other Resident Wildlife

Upland Game Birds

Populations of chukar and sagegrouse in the local area increased slightly due to a mild winter. Production would have been higher, but a cool, wet spring delayed the nesting season and forced some to reneest. Pheasant and California quail populations experienced the same weather conditions, but seemed to be more successful at reneesting.

Muskrats

The annual muskrat house survey in January indicated a total of 8 muskrat houses on the refuge. Although Malheur Lake water levels have dropped significantly since the peak of the flooding in 1986, no houses were found, and the lack of emergent vegetation continues to be the limiting factor. Muskrat house surveys in the Double-0 area also revealed none, while the Blitzen Valley had 8 in 3 ponds. Drought conditions in these areas have reduced house numbers from 1989 totals of 222. In 1988, the refuge supported about 12,000 houses!

Rabbits

In an effort to save time, but still continue monitoring rabbit populations on the refuge, the number of annual surveys was reduced from 4 seasonal counts to 1 winter count. This single survey consists of three 11-mile routes run over 3 consecutive nights, one half hour after sunset, during the dark phase of the moon. A comparison of population levels between 1990 and 1991 indicated a significant decrease of 68 percent. Since the population appeared to reach a peak in 1989 and 1990 this decrease represents a natural population crash that occurs about every 10 years.

Coyotes

Coyote scat surveys were initiated during the fall of 1987 as a means of evaluating the effects of the predator control program on relative coyote abundance. Three years later the refuge added a winter survey to provide a comparison abundance index prior to the predator control season. Table XXXVII provides a summary of coyotes removed and corresponding fall and winter abundance indices on Malheur Refuge for the years 1987 - 1991.

During 1991, both fall and winter surveys indicated an increase from 1990. The fall index increased from .38 to .43 (13%) while the winter index increased from .14 to .26 (86%). The Oregon Department of Fish and Wildlife also conducted a general spring coyote index for the entire county. The index remained at the same level between 1990 and 1991. However, the Oregon Department of Fish and Wildlife feels that the actual index for 1991 increased by 25 percent as a result of a late, cool, wet spring which dispersed coyotes during their survey period. The increase in refuge indices tend to support their theory. During this period a total of 209 coyotes were removed from the refuge, 72 more than 1990. However, the 1990 trapping season was 2 weeks shorter than 1991.



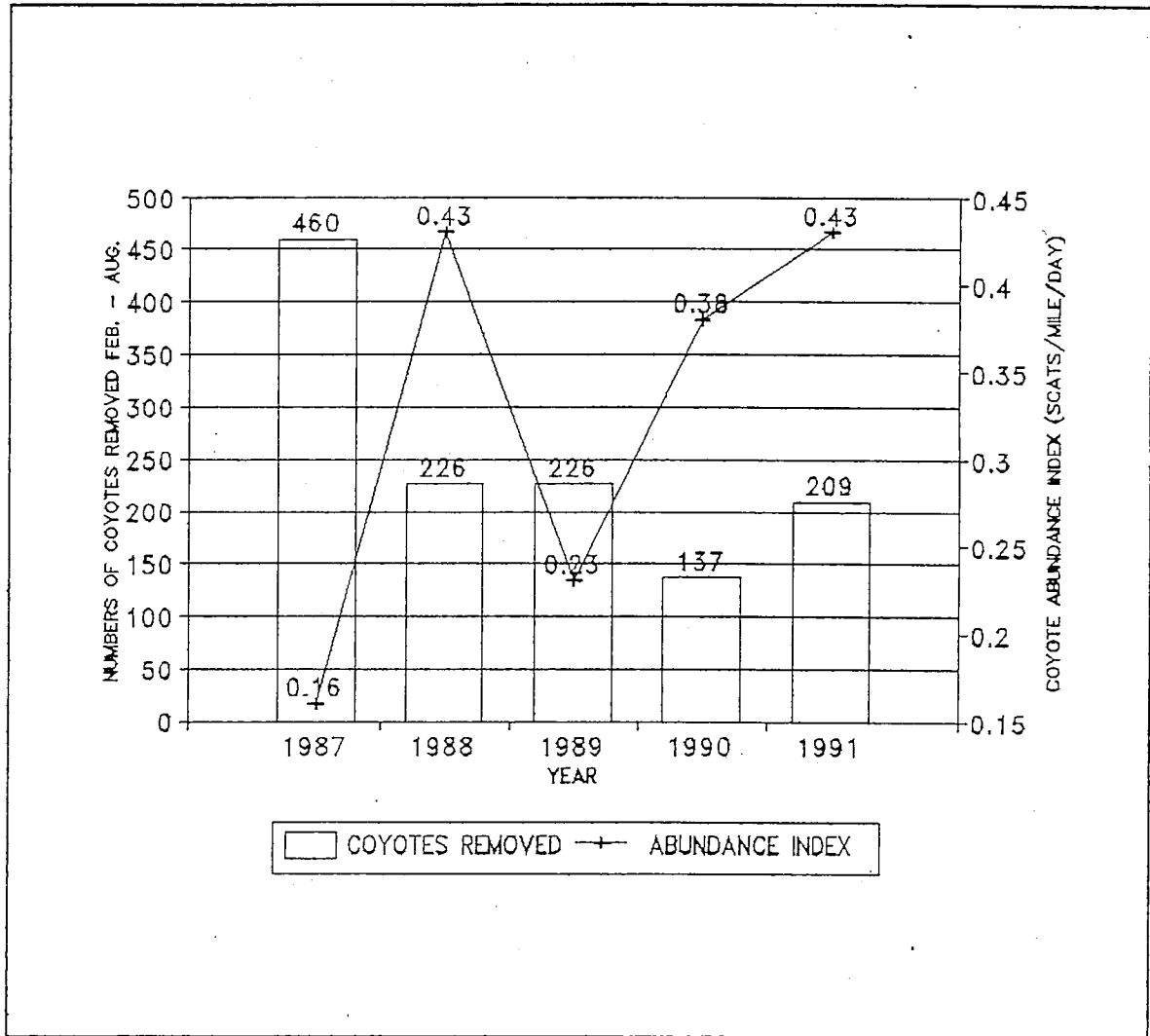
Volunteers from New York, Dick and Frieda Vetter, conducted coyote scat surveys for the second year at the refuge. RV 8/91

Overall, the number of coyotes removed from the refuge during the past 4 year has been consistent, while the coyote abundance index has varied considerably. This is probably due to new arrivals from outside the control area and local movements on the refuge. Figure III illustrates the numbers of coyotes removed between February and August of each year and the corresponding abundance index (scats/mile/day) conducted in September after the trapping season. Considering the variables involved with the surveys--coyote movements, extreme weather and habitat changes that occurred during this time period--an analysis of these data would be difficult and questionable. An example of the difficulty in analysis would be that 2 of the 20 transects conducted in 1991 accounted for 52% of the scats counted. Discounting these transects would change the fall figure from .43 to .05.

Table XXXVII Numbers of Coyotes Removed and Corresponding Fall Coyote Abundance Indices on Malheur Refuge for the Years 1987 - 1991.

YEAR	NUMBER OF COYOTES REMOVED	ABUNDANCE INDEX SCATS/MILE/DAY	
		Fall (Sept)	Winter (Jan)
1987	460	0.16	_____
1988	226	0.43	_____
1989	226	0.23	_____
1990	137	0.38	0.14
1991	209	0.43	0.26

Figure III Coyotes Removed from Malheur Refuge and Fall Abundance Indices, 1987 - 1991.



11. Fisheries

In August, a group of people from the Oregon Department of Fish and Wildlife and the Malheur Refuge fire crew assisted refuge personnel and volunteers placing juniper tree rip-rap, to stabilize the stream bank and improve trout habitat, along two 100 yard sections of eroded stream bank between the Page Springs dam and P-ranch on the Blitzen River. This was the fourth consecutive year the project had taken place.

Additionally, a group of fifth graders from Burns, Oregon assisted refuge personnel and Oregon Department of Fish and Wildlife in planting willows along 300 feet of lower Bridge Creek as part of a fisheries habitat improvement program for their annual "outdoor class" at Malheur Refuge.

Five new fish containment screens were ordered in 1991 to control carp movement at ponds throughout the refuge. Including the supply of existing screens, plans for 1992 call for the installation of 10 containment screens which will bring the operating total to 13. Currently two screens are operating at the Page Springs dam and one at the Double-O unit. Hopefully, when all these screens are operating the number of ponds infested with carp will be reduced and provide better habitat for waterfowl and wildlife.

12. Wildlife Propagation and Stocking

Rainbow trout were stocked in the Blitzen River and Krumbo Reservoir during the past year. This effort was recommended and approved in the Fisheries Management Plan for the Blitzen River. The purpose of stocking is to reduce fishing pressure on wild trout and to provide recreation experiences.

Krumbo Reservoir received 13,000 fingerling rainbow trout in early May and 5000 catchable sized rainbow trout in late May and July. In June, 5000 catchable-sized rainbow trout were stocked in the Blitzen River between Page Springs and P-Ranch.

In cooperation with the Oregon Department of Fish and Wildlife, 8 ringed-necked pheasants were trapped in the Blitzen Valley. The birds were released at the state's Summer Lake Wildlife Area in an effort to improve the stock by using Malheur Refuge's hardy birds. During 1990, 40 Ring-necked Pheasants were transferred to the Summer Lake Wildlife Area.

15. Animal Control

Predator Control to Enhance Greater Sandhill Crane Production

On 25 November 1985, the U.S. Fish and Wildlife Service (Service) issued a final environmental assessment entitled "Alternatives to Enhance the Production of Greater Sandhill Cranes on Malheur National Wildlife Refuge, Oregon". This assessment, outlined a 21 percent decline in breeding pairs of sandhill cranes on Malheur Refuge from 236 in 1971 to 186 in 1985. The primary cause for this decline was low recruitment of young due to high nest predation by ravens, raccoons and coyotes, and high predation by coyotes on chicks before

fledging. In an average year, predators destroyed 45 percent of all crane nests on the refuge and 85 percent of the chicks that hatched failed to fledged.

The EA proposed that efforts to improve sandhill crane nesting habitat continue and that coyotes, ravens and raccoons would be controlled for three years (1986-1988). The purposes of the control efforts were to: 1) increase sandhill crane nesting success to 75 percent, fledging success to 25 percent, and annual recruitment to a minimum of 15 percent on a sustained basis; 2) reach refuge production objectives of 150 crane chicks annually; and 3) reverse the current downward trend in the refuge crane population.

Following the successful three years of the trial predator control program, a new draft EA to extend the program was released for public review and comment on February 10, 1989. The plan called for extension of the control program for an additional five-years to enhance the distressed refuge sandhill crane flock. It was approved by the Regional Director on March 29, 1989.

The nesting population of greater sandhill cranes on Malheur Refuge had declined from 236 pairs in 1971 to 181 pairs in 1986 when predator control began. The population continued to decline to 168 pairs in 1989. Some of the decline (14 pairs) is attributed to lost habitat on Mud, Malheur and Harney Lakes due to record high lake levels. Losses on Mud, Malheur, and Harney lakes had already taken place by 1986, but could not be verified until a comprehensive pair count was done in 1988. The remainder of the decline is attributed to the low recruitment of young into the population during the years 1971 through 1985.

The year 1991 was the sixth year of the predator control program. In 1991, a total of 214 crane pairs were counted on the refuge. This represents a significant increase compared to the 177 pairs counted in 1990. This is an increase of 37 pairs over 1990 numbers. These new recruits are a result of our efforts towards reducing predator impacts on crane production.

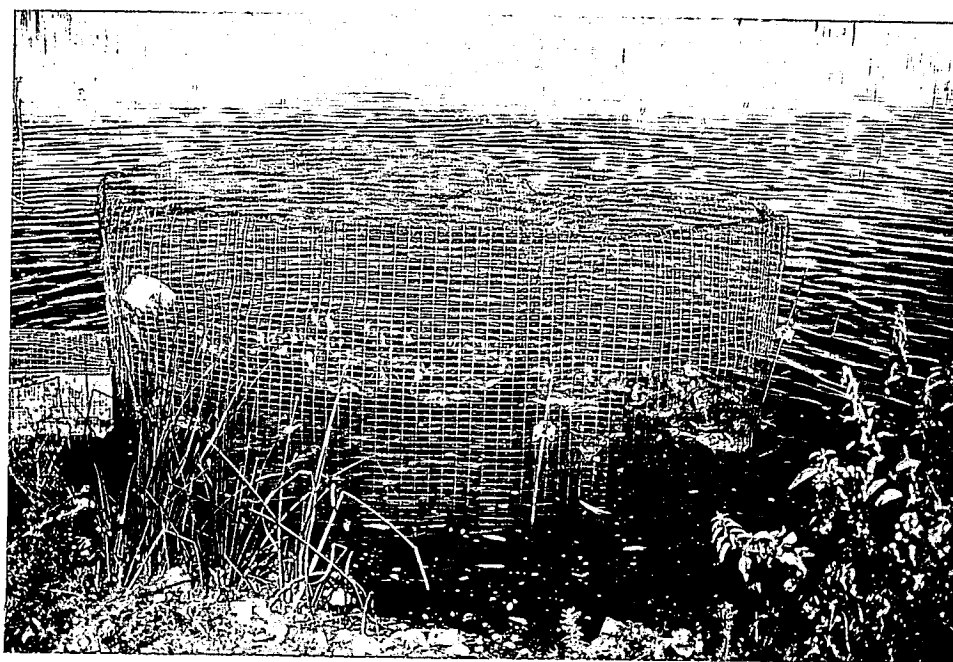
In 1991, 209 coyotes were taken by the following methods: aerial gunning (33 percent), calling and shooting (21 percent), trapping and snares (39 percent), and denning (7 percent). An estimated 33 ravens were removed using 33 dozen eggs injected with DRC-1339 and an additional 15 ravens were shot. Three raccoons were taken by trapping plus five by shooting, for a total of eight.

The sandhill crane objectives of the 1991 effort were to have a nesting success of 75 percent, fledging success of 25 percent, and recruitment of 15 percent. The actual outcome

was 50 percent nesting success and seven percent fledging success, yielding a recruitment rate of 3.4 percent. Poor weather appeared to be the main cause of low productivity this year, although a study of crane colt survival showed predators to be a problem still.

16. Marking and Banding

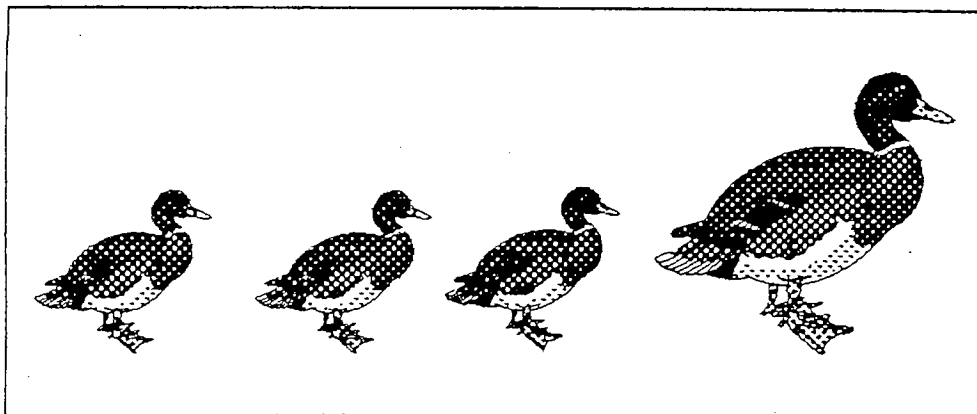
Table XXXVIII summarizes waterfowl and other birds banded during the 1991 season at Malheur Refuge. Due to the cold wet spring, young mallards were particularly scarce and as a result few were banded. Four of the trumpeter swans were relocated from Red Rocks Lake Refuge and also marked with green numbered neck collars. Bobolinks were banded as part of a study conducted by Dr. Tom Gavin at Cornell University. Blood samples were taken from each bird for a genetic study comparing eastern and western populations of bobolinks in the United States.



One of five successful duck traps used at the refuge to capture waterfowl for banding program. RV 8/91

Table XXXVIII Summary of Birds Banded at Malheur Refuge
in 1991.

SPECIES	SEX/AGE	NUMBER BANDED
MALLARD	AHY-M	274
MALLARD	AHY-F	272
MALLARD	L/HY-M	24
MALLARD	L/HY-F	29
MALLARD TOTAL		599
N. PINTAIL	----	4
GADWALL	----	1
WOOD DUCK	----	1
CINNAMON TEAL	----	13
REDHEAD	----	35
TRUMPETER SWAN	----	17
WATERFOWL TOTAL		670
SANDHILL CRANE	----	8
BOBOLINK	----	12
TOTAL BIRDS BANDED		690





Hannah Taylor, one of the youngest volunteers, assisting with the duck banding program. RV 8/91

17. Disease Prevention and Control

Biologist Gary Ivey assisted personnel at the Modoc National Wildlife Refuge in late August with an outbreak of botulism on Goose Lake in Oregon and California. Malheur Refuge supplied the airboat for monitoring the month long outbreak. An estimated 3,000 birds were lost as a result of the botulism outbreak.

H. PUBLIC USE1. General

Total refuge visits appeared to be consistent with the previous two years. Table XXXIX summarizes refuge visitation by year.

Table XXXIX Estimated Visitation at Malheur Refuge.

YEAR	VISITS
1983	19,888*
1984	11,180*
1985	22,080
1986	24,600
1987	39,670
1988	36,000
1989	43,200
1990	43,910
1991	43,050

*Flooding significantly reduced vehicle access during these years.

Bird watching, photography and other non-consumptive wildlife oriented activities continue to account for most refuge visits. Most visitor use is in the spring and coincides with the spring migration. Malheur Refuge is listed by Roger Tory Peterson to be one of the top ten "birding hotspots" in the United States and regularly appears in newspapers, magazines, guidebooks and television travelogues. Since Malheur is located in a remote area with few public use facilities, visitors are generally destination-oriented and extremely independent.

The Bureau of Land Management's Steens Mountain National Recreation Area, a 66 mile National Scenic Byway, borders the refuge on the south. Recreational use levels are monitored through car counters placed along the loop road entrances.

According to their data, 47,916 people visited the Steens in 1991 and all of them had to drive through the refuge to get there. Since this drive is only open from July to November, and most birders visit the refuge earlier in the season, actual numbers of visitors passing through the refuge is actually much higher than indicated by Table XXXIX.

2. Outdoor Classroom - Students

Malheur Refuge was used extensively by elementary, high school and college students during 1991. Although the refuge staff does not get too deeply involved with most of these field trips, there is usually someone available to provide a brief introduction to the area and orient groups to the things they wish to see and do.

The Malheur Field Station, located on the refuge at an old Job Corps facility, operates under a cooperative site agreement with the Service and provides support services for education and research in the Great Basin. It is supported by a consortium of 26 universities, colleges and natural resource-related organizations and thousands of people use its facilities annually.

5. Interpretive Tour Routes

As a follow-up to the public use planning workshop that was held at Malheur in October of 1990, the Oregon High Desert Discovery plan was created. (See Section D3)

6. Interpretive Exhibits/Demonstrations

The refuge headquarters continues to be the main attraction and only exhibit area on the refuge at this time. The Benson Memorial Museum contains nearly 200 mounted specimens of birds known to have been observed in the area. These mounts have been placed in life like poses and serve as an identification guide for both beginning and expert birders. There are also two small display cases in the refuge headquarters office that introduce visitors to the archaeology of the area.

During the 1991 year planning and development of interpretive exhibits for the Buena Vista Overlook was completed. These signs and interpretive panels were paid by 1991 station funds and should be installed by July 1992.

7. Other Interpretive Programs

Refuge personnel played a large part in the planning and running of the Tenth Annual John Scharff Migratory Bird Festival in April. The festival coincides with spring waterfowl migration and has turned into one of the biggest birding events in the northwest, drawing hundreds of out-of-town visitors to the area. By providing guest speakers, tour guides, workshop leaders, slide shows, booths, wildlife art, a banquet and much more the local community has turned this event into a fun packed three day birding ritual.

8. Hunting

For the first time waterfowl hunters on Malheur Lake were required to have a special use access permit. This was because that portion of the refuge is very popular with illegal artifact collectors and visitation to this area is extremely difficult to monitor. Requiring these permits allowed the refuge staff to get a better idea about visitor use on the lake.

Despite the poor hunting conditions, approximately fifty different individuals applied for over eighty of the two-day permits. For the most part, hunters were using the refuge during the later part of the goose season. Lack of food or cover on these previously flooded shorelines continued to be the limiting factors, especially for duck hunters.

The portion of the refuge between Diamond Lane and Sod House, known as the Buena Vista Area, was open to upland game hunting during the last sixteen days of the state pheasant season. This was seven days longer than previous upland game seasons on the refuge. The Oregon Department of Fish and Wildlife set the state pheasant season a week later than in 1990, allowing a longer upland game hunting season that did not conflict with migratory bird use of the refuge.

Approximately 400 hunters participated in the Buena Vista Area hunt in 1991. This was quite similar to the 1990 estimates, however, the main difference was that these hunter visits were spread out over sixteen days. Hunting pressure was significantly lower opening weekend and many hunters seemed to enjoy more freedom on the only parcel of land in Harney County that offered a quality pheasant hunt.

Chukar populations on the refuge increased slightly as a result of a mild winter. Hunting pressure was extremely low. Less than 50 hunters are estimated to have ventured into the rimrock habitat west of State Highway 205 in the Blitzen Valley.

9. Fishing

Krumbo Reservoir and the Blitzen River continue to provide enjoyable fishing opportunities for anglers. The bulk of the creel was rainbow trout, which were stocked by the Oregon Department of Fish and Game, however, large-mouthed bass fishing seems to be growing in popularity. The two best months to fish for trout are May and October when cooler temperatures prevail. During the warmer months, bass fisherman in float tubes and boats with electric motors are quite effective at fishing in the aquatic vegetation that takes over Krumbo Reservoir.

17. Law Enforcement

Four Refuge Officers were assigned routine patrol when hunting and fishing seasons were open on the refuge, e.g. opening of fishing season, opening of waterfowl season, during the pheasant season and while the state deer season was open. Visits by the hunting public were not especially numerous, although quite a few fishermen participated in opening ceremonies at Krumbo Reservoir and pheasant hunting was popular. Hunting for waterfowl has not been particularly good on Malheur Lake as the great flood of the 80's removed all of the emergent vegetation and left a mudflat in its wake, consequently, very few waterfowlers visited the refuge. No citations were issued to hunters or fishermen.

Although scheduled patrols were not conducted looking for artifact hunters, this category of violation netted the most effort and success. About a-half-dozen tickets were handed out, all resulting in convictions. Most were cited under 16 USC 668dd; 50 CFR 27.62 which prohibits looking for or removing objects of antiquity.

A case was concluded in 1991 which resulted in the conviction of three individuals illegally digging at an archaeological site under state cultural resource protection law. The violation, detected in 1990, by Refuge Officer Rick Vetter was occurring on private property just a few feet from the refuge boundary. The case was turned over to the State Attorney General's Office for prosecution under an Oregon law which requires that anyone digging for artifacts on state or private land in Oregon must secure permission from the local tribe (most collectors who dig up sites are reluctant to ask the tribe for permission to dig up their ancestors). This was the first time a conviction was obtained under this state law.



Looting of American Indian burials was an all too common occurrence when the Malheur Lake floodwaters receded. This desecrated grave may have contained the cremated remains of a witch or sorcerer. CB 8/91



A typical wildlife viewing opportunity in the wetlands on the refuge. JO 7/91

I. EQUIPMENT AND FACILITIES

1. New Construction

Boundary fence construction went into full gear in 1991. Work was completed through a variety of means including force account (Refuge fire crew), a fence contractor and by agreement with adjacent landowners. During the summer and early fall the fire crew built nearly ten miles of boundary fence north of Harney and Mud Lakes. Several Refuge neighbors agreed to construct over twenty miles of fence along our boundary. The standard agreement stipulated that the refuge would provide the materials and the adjacent land owner would provide the labor. As an added incentive, the local Agricultural Stabilization and Conservation Service (ASCS) office was cost sharing with local ranchers and farmers to reconstruct fences and other improvements destroyed by flooding in the 1980's.

By mid October, a fence contractor from Lakeview, Oregon was hired to construct approximately 34 miles of boundary fence on Malheur Lake and in the vicinity of the Buena Vista Substation. By late December, approximately 12 miles of fence along the southern boundary of the lake was completed under the contract.

Fence construction has been a high priority at the refuge since flooding in the 1980's. This was the first year that a vehicle could safely negotiate those previously flooded areas without having flotation devices. Even so, travel into the drying mudflats of Malheur Lake was undertaken at one's own risk. Still the effort was important as a boundary fence tends to discourage archaeological vandalism and other human trespass and should eliminate cattle trespass which has been an ongoing source of frustration since flood waters destroyed about 100 miles of boundary fence in the refuge's lake region.

Table XXXX Boundary Fence Construction.

Constructor	Mileage Completed	Location Of Fence
Adjacent Landowners	18.00 Miles	Malheur Lake
Fire Crew	2.75 Miles	Mud Lake
Contract	9.50 Miles	Harney, Mud and W. Malheur Lakes
	6.00 Miles	North, South, East Malheur Lake
TOTAL	36.25 Miles	

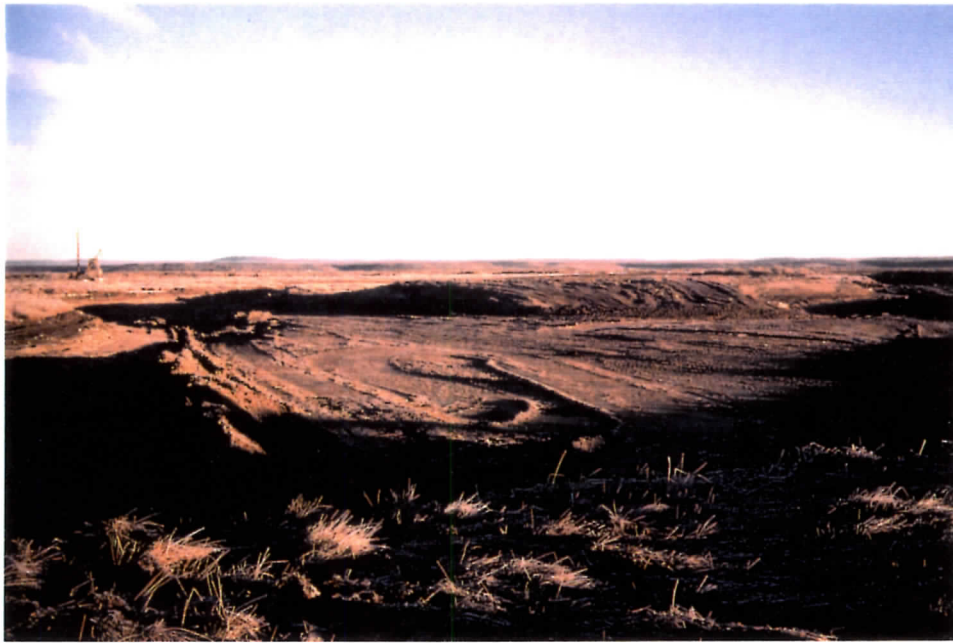
In addition to boundary fence construction projects, the refuge was able to secure funding to build some new or replacement facilities. A complete list of construction, maintenance, and rehabilitation projects is contained in Table XXXXI .

New construction highlights include:

- Headquarters walkways replaced for improved disabled access.
- Replacement rock checks in twenty locations.
- A new parking lot at Krumbo Reservoir.
- Water wells drilled at Nine Mile Corral and Diamond Swamp.
- A shop storage building to replace the Kado Barn.
- The Windmill Brood Pond was constructed in the Double-O unit.
- A ditch was dug to supply spring water to Windmill Pond.
- Redrilled a well to supply water to Windmill Pond.
- A water supply line from the well to Windmill Pond was laid.
- Constructions of Mud Creek Brood Pond initiated.
- Constructed the Stubblefield Brood Pond.
- Constructed the North Swamp Brood Pond.
- Constructed the Center Sage Brood Pond.



The recently completed and filled Windmill Brood Pond at the Double-O, was a showcase success. The pond provides late season brood water for a large, otherwise, waterless portion of the refuge. JO 5/91



Depth of Windmill Pond is apparent prior to filling with water. JO 3/91



It Works! Deputy Manger Walsworth inspects the business end of the 1/2 mile long water line delivering well water to the completed Windmill Brood Pond. Ditch that carries spring water is shown entering pond at upper left. JO 4/91



The rye grass seeded along the southeast side of Windmill Brood Pond established a good stand. JO 6/91



Phase One of a two year project to improve public use facilities at Krumbo Reservoir was completed. LM 5/91



Old rock walkway between the main office and lower office slated for removal to improve disabled access. LM 9/91



Improving the walkway between the main office and the lower office allowed for 100% disabled access to all headquarters buildings. LM 9/91

2. Rehabilitation

Rehabilitation of damaged facilities, structures and habitat required an inordinate amount of time due to the destruction wrecked upon them by the great flood of the 1980's. Major damage was done to dikes, roads, control structures, canals, ditches, fences and outbuildings. Nearly all the wetlands were degraded by the invasion of massive numbers of carp and the loss of aquatic vegetation. Because of the duration of the flood, nearly ten years, marsh vegetation invaded traditional meadow habitats and required mechanical treatment for restoration. A partial list of the larger rehabilitation projects completed in 1991 includes:

- Fence replacement on about 37 miles of boundary (see Table XXXX).
- Lower office was remodeled and modular furniture was installed for 5 office spaces.
- More than 6 miles of ditch was cleaned (see Table XXXXI for specific ditches).
- Complete rehabilitation of 2.5 miles of dike.
- Pipe and riser replacement (50+ installations).
- Bridge to Benson Boat Landing was replaced.
- Replaced 1/2 mile of underground electric line to Buena Vista well.
- Bank stabilization along the Blitzen River and Bridge Creek

3. Major Maintenance

Major Maintenance projects were accomplished on vehicles, buildings and water control structures. Although a heavy equipment mechanic is not on staff, the maintenance staff was actively involved in the repair of heavy equipment by doing much of the preliminary work, such as diagnosis and part removal, and then taking the broken parts to town for repair.

A temporary carpenter was on staff for the second consecutive year and has begun reducing the backlog of building maintenance projects. His talents have been sorely needed for some time and the refuge is fortunate to have someone with his abilities.

An emphasis at headquarters has been to improve the landscaping. Trees were planted and hedges were started. Most plantings were made so that visitors views of the shop, equipment storage yard and building material supply area would be screened. Drip lines were installed and seedlings and hedges were fenced to protect them from marauding deer and to insure the plants survival. Some work and materials cost hard cash, but much of the work was volunteered by Mike Reilly and Laurie O'Connor.

Several major maintenance projects were completed this year, among the more significant efforts were:

Major Vehicle Maintenance

- Gallion grader brakes and transmission cooler
- Forklift transmission repair, hydraulics overhaul
- JD Wheel Tractor(2440) rebuilt hydraulic pump
- HD 16 Dozer major overhaul of tracks
- Cat D-8 Dozer clutch replacement

Major Building Maintenance

- Headquarters landscaping
- Quarters 9 landscaping, block wall, sidewalks
- Quarters 13 sidewalks
- Quarters 00 siding
- Quarters 00 replaced pump in domestic pump
- Fire building clean out
- Painted interior of Quarters 2.

Major Structure Maintenance

- Double "O" Domestic water pump replacement
- Road Maintenance 100+ miles
- Bridge maintenance 3 structures re-decked, 1 replaced
- Fence maintenance 50+ miles
- Dike and road mowing 150+ miles
- Water control structure maintenance, cleaned out 100's



Winter operation of fish screens presented some unusual maintenance dilemmas. JO 1/91

Table XXXXI Malheur Refuge Maintenance, Rehabilitation and Construction Projects, 1991.

UNIT	Field Name	Work Description
1	Special Use Permit	Monitored for compliance
1	Water Management	Water Control per Water Mgmt Plan
1	Center road	Mowed roads and hauled gravel
1	Grain Field	Grain/rye planted
1	Stinking LK Road	Mowed road 4 mi.
1	U. Swamp Field	Cleaned ditch 800'
1	U. Swamp Field	Installed pipe and screwgate
1	L. Swamp Field	Installed 4 pipe & riser in Carp Pond
1	Windmill Pond	Enlarged Pond, built islands
1	Windmill Pond	Installed buried water line from well
1	Windmill Pond	Replaced pump in well
1	Hughet	Cleaned ditch 1,000'
1	Hughet/Willard	Cleaned Goulden Canal 3.5 mi.
1	Yriarte/Lower Swp	Cleaned Goulden Canal 2 mi.
1	"OO" HQ	Replaced siding on quarters
1	"OO" HQ	Replaced siding on pump house
1	Boundary	Replaced 4.5 mi. of boundary fence
5	HQ	Installed handicap accessible sidewalks
5	HQ	Improved handicap parking area
5	HQ	Landscaped Quarters 9 & 13
5	HQ	Poured new concrete sidewalks to Qtrs 9 & 13
5	HQ	Planted trees in HQ area
5	HQ	Developed new hedge to screen residences
5	HQ	Installed drip lines to all new plantings
5	HQ	Rebuilt bridge over Blitzen River
5	HQ	Developed brush piles with tree limbs
7	CPR	Blade Center Patrol Road
7	CPR	Control weeds along Center Patrol Road
7	Special Use Pmit	Monitored for compliance
7	Water Management	Water Control per Water Mgmt Plan
7	Blitzen Dams	Maintain Fish passage/Carp Interdiction
7	East Sagebrush	Cleaned Ram Ditch 4 mi.
7	East Sagebrush	Installed 2 pipe and riser
7	Rockford Lane	Cleaned Stubblefield Canal 4 mi.
7	Thoroughbred	Repaired 6 spreader dikes
7	Thoroughbred	Cleaned irrigation ditch 1,320 ft.
7	Thoroughbred	Repaired 5 wash-outs in ditch
7	N. Sodhouse Pond	Repaired Sodhouse Pond dike
7	North Sodhouse	Repaired dike 500 ft.
7	North Sodhouse	Replaced CMP and riser
7	North Sodhouse	Repaired spreader dikes
7	North Sodhouse	Repaired wash-outs
7	North Sodhouse	Repaired Rineman Ditch
7	Coyote Butte	Re-post visitor/hunter signs
7	McLaughlin Slough	Installed new pipe under CPR

Table XXXXI Continued

UNIT	Field Name	Work Description
8	Rim Rock	Clean ditch 300 ft.
8	North Meadow A	Build new dike 700 ft.
8	North Meadow A	Repair dike
8	North Meadow A	Repair water control structure
8	Unit 8 Pond	Replaced pipe and riser
8	Unit 8 Pond	Graveled cannon net site
8	Little Sagebrush	Install new culvert under Rockford Lane
8	Rocky Ford Lane	Repaired water control structure
8	Pintail Pond	Cleaned outlets 400 ft.
8	Center Sagebrush	Replaced pipe and riser
8	Center Sagebrush	Repaired dike
8	Center Sagebrush	Constructed new brood pond
8	E. Big Sagebrush	Replaced pipe and riser
8	E. Big Sagebrush	River bank stabilized with rock
8	EE. Big Sagebrush	Repaired 6 spreader dikes
9	Ruthaford Lane	Replace pipe and riser
9	Diamond Swamp	Rebuilt 4 mi. of fence
9	N Swamp Field	Replaced pipe and screw gate
9	N Swamp Field	Constructed new pond
9	S Swamp Field	Rebuilt dike, 1500 ft.
9	Buena Vista HQ	Replaced underground power line, 2640 ft.
9	Entire Unit	Mowed dike tops, 6 mi.
10	W Grain Camp	Replace 2 pipes and risers
10	E Grain Camp	Cleaned ditch, 600 ft.
10	Krumbo Valley	Enlarged and improved 2 parking lots
10	Krumbo Valley	Re-graveled main entrance road, 3 mi.
10	Butte Field	Cleaned North Canal, 1.5 mi.
10	Blitzen River	Replaced bridge deck
10	Lower Krumbo Pond	Repaired dike, 400 ft.
10	Upper S. Krumbo	Cleaned ditch, 600 ft.
10	East Hamilton	Cleaned ditch, 1200 ft.
10	Witzel Field	Stabilized river bank, 100 ft.
11	Jones Field	Installed 12 pipe crossings
11	Dredger #2 Field	Cleaned ditch, 1500 ft.
11	South White Field	Cleaned ditch, 1000 ft.
11	Center Patrol Rd	Repaired wash-outs and muskrat holes
11	South Swamp Field	Cleaned spoil from dike top
12	Big Deer Park	Cleaned ditch, 2000 ft.
12	Big Deer Park	Built rock check structures (4)
12	Big Dry Field	Built rock check structures (6)
12	Big Dry Field	Cleaned ditch, 2000 ft.
12	Island	Cleaned ditch, 1000 ft.
12	Island	Built rock check structures (3)
12	Island	Repaired P Ranch Pond dike
12	South Meadow	Built rock check structures (12)
12	Barley Field	Cleaned ditch, 2000 ft.
12	Barley field	Installed 2 pipe crossings

Table XXXXI Continued

UNIT	Field Name	Work Description
12	E. Big Juniper	Cleaned ditch, 1000 ft.
12	E. Big Juniper	Built rock check structures (3)
12	Baker Field	Cleaned ditch, 800 ft.
12	N. Little Juniper	Installed pipe and riser in Bridge Creek Pond
12	Faye	Cleaned ditch, 500 ft.
12	Faye	Repaired Five Mile Dike
12	Faye	Built rock check structures (4)
12	Bridge Creek	Cleaned ditch, 1000 ft.
12	Bridge Creek	Repaired dike
12	Warm Springs	Cleaned ditch, 1000 ft.
12	Warm Springs	Repaired cement water control structure
12	Special Use Prmt	Monitor for compliance
12	Water Management	Water Control per Water Mgmt. Pl

4. Equipment Utilization and Replacement

The equipment fleet at Malheur Refuge is a collection of primarily aging machines, many in desperate need of replacement. No replacements were acquired this year for these machines. Despite being old and tired, nearly all of these machines saw a lot of service this year; in part because receding flood water made maintenance possible, but also because of added emphasis and a late, dry fall which allowed field work to continue through November. This year, our fleet of heavy equipment amassed a total of nearly 4000 hours of use.

The refuge has five dozers which range in age from 10 to 40 years old. Collectively, these machines were used for over 850 hours. Two graders, a 1983 Champion and a well used Gallion, acquired on surplus in 1966 were used for 325 hours this year for road maintenance activities on the refuge.

There are only two backhoes in the equipment fleet and they must cover the 75 mile length of the refuge. These essential machines are the primary tool used to maintain the over 90,000 acres of wetlands on the refuge. One backhoe is fairly new, manufactured in 1987, the other was made in 1974 and is showing the wear of 18 years of every day use.

Our most vital piece of equipment, also in the worst condition, is the Michigan bucket loader. This year it was patched together several times and even with breakdowns over 300 hours of use were put on the machine. Repairs to just the

bucket took 4 days. It could almost be said (without grinning) that there is as much steel welding rod in the bucket as there is original material.

Four draglines and cranes receive considerable use, especially as ditches, drains and canals which sustained heavy flood damage are repaired. Those machines were used a total of 1000 hours.

The refuge leases a 12 yard dump truck from GSA and owns two dump trucks. Both refuge trucks are aging and in need of replacement, each received about 100 hours of use, but that amount of use alone does not represent our actual need for machines of this type. Because of their lack of reliability and small size, we were obliged on two separate occasions to borrow dump trucks from Stillwater Refuge (two trucks) and from the Forest Service (two trucks). At least another 200 hours of dump truck use was accumulated using borrowed equipment.

The last piece of equipment that needs to be singled out for mention is the John Deere agricultural tractor. This machine has not exactly "run like a deer"! It has been a constant source of irritation, breaking down frequently and spending excessive amounts of time in the repair shop when there was a pressing need for it's service in the field. The tractor was built in 1985, so its age is not a factor in its unreliability and the use it receives is fairly light. There was a factory recall in 1991 which saw this machine split in half to repair its ever faulty hydraulic system. Hopefully, this will end it's career in the repair shop and we will get the kind of service you expect from a John Deere tractor. We were only able to put 150 hours on the tractor, but would probably use it for 300 hours if it were available.



Always anxious to get started in the spring, an anonymous equipment operator (conveniently hiding just out of view of the camera) got the D-4 mired in mud. Bruce Aldrich provides the towing assistance. JO 4/91



You don't rip very deep on cold (-20°F) December Mornings. JO 12/90



The D-8 Cat Dozer saw a lot of action as seen in these two photos.

Whether ripping, dozing or pulling a scraper, this aging, worn-out machine was indispensable to our field operation. Equipment operator Tom Downs at the controls with Bruce Aldrich wielding the screwdriver. JO 12/90



Equipment Operator Aldrich digs the trench for the waterline to the newly constructed Windmill Brood Pond. JO 3/91



Draglines and cranes logged over 1000 hours of use and were frequently seen atop our GSA leased transport moving from job to job. JO 3/91

5. Communication Systems

Twelve new portable 2-way radios were purchased for the refuge in 1991: five King portables, one Motorola Saber submersible portable, and 6 Midland XTR mobile vehicle units. Six radios which were more than 16 years old were surveyed leaving a total of 56 2-way radios in use. The Burns BLM installs and repairs all refuge radio equipment via an interagency agreement.

6. Computer Systems

Malheur refuge added 7 new computers this year: two 386 systems, four 286 systems, and one notebook 286. Five more HP Deskjet 500 printers, with quiet laser quality printing, were also purchased to complement the systems. An ink refill kit enables us to cut the expense of purchasing new ink cartridge from \$20.00 to \$1.00. A new graphics card upgraded our old IBM-XT computer to enable it to display graphics and preview screens using Wordperfect. Computer generated travel vouchers and purchase orders are two new uses of computers at Malheur. Several routine tasks have also been computerized including special use permits, fuel sheets, water management field forms, maintenance work lists, leave records, and the monthly car pool. Everyone is becoming more proficient at discovering

practical uses for their computers which simplify everyday tasks. The refuge now has 11 desktop systems with number 12 (a 486 for GIS) on order and 2 portable computers which are used constantly by almost all refuge employees.

The National Ecology Research Center transferred Malheur data base information including biological units, fenced units, elevations, ownership, refuge boundaries, nest sites, and crane territories from the Analytical Mapping System (AMS) format to ARC/INFO. The National Wetlands Inventory polygon wetlands data will be converted in 1992. ARC/INFO will be able to overlay all this information and related data base information in the form of tables to create maps, charts, and models for habitat, fire, and other management decisions.

7. Energy Conservation

The refuge participated, in 1991, with Harney Electric Cooperative and the Bonneville Power Administration to winterize three employee quarters. The program provided by the power companies provided a energy audit of the buildings and then funded about 70% of the recommended energy saving improvements. We expect this trial program to be expanded next year when we will have all remaining quarters inspected and outfitted with energy saving devices.

J. OTHER ITEMS

1. Cooperative Programs

Trumpeter Swans

For the past few years, Biologist Gary Ivey has been working cooperatively with the Oregon Department of Fish & Wildlife to seek approval from the Pacific Flyway Council to begin a project aimed at improving Oregon's trumpeter swan flock. The project was approved in July 1990. This trumpeter swan project has two goals. The first is to teach the trumpeters of the Malheur flock to migrate to a more favorable wintering area, thereby reducing winter mortality; and secondly, to establish at least two new breeding flocks at other significant wetland sites in central and eastern Oregon.

The 18,000-acre Summer Lake Wildlife Area was designated as the most appropriate wintering area for our trumpeters. This area is managed by Oregon Department of Fish and Wildlife, and is located about 80 miles west of Malheur Refuge. Summer Lake contains both excellent wintering and breeding habitat for trumpeter swans and has been chosen as a future breeding site as well. In addition to Summer Lake, the feasibility of establishing a breeding flock at Klamath Marsh National Wildlife Refuge has been looked into. This refuge was recently expanded to include about 30,000 acres and has the potential to provide excellent trumpeter breeding habitat.

The swan project began in July, when four non-breeding trumpeters were acquired from Red Rock Lakes National Wildlife Refuge and transplanted them to Malheur Refuge. Two non-breeders were also moved from Malheur to Summer Lake. The Red Rock Lakes birds were brought in to enhance the genetic makeup of the Malheur flock and as insurance against the flock's decline in the event that the birds moved to Summer Lake did not return.

Another result of the swan plan is the selection of Summer Lake by the Rocky Mountain Trumpeter Swan Study Committee as a site to transplant wintering birds from the Henry's Fork of the Snake River. During late November, Biologist Ivey assisted Oregon Department of Fish and Wildlife personnel in the transportation of 100 trumpeters to Summer Lake. This action was undertaken to prevent future trumpeter swan losses on this over utilized, traditional swan wintering area. Ruth Shea was designated by the committee to conduct surveys of potential winter sites for Henry's Fork swans. After visiting Summer Lake last May, she reported the area has the best

potential as a site for transplanting wintering trumpeters of all the areas she has surveyed to date. This project will likely enhance goals for trumpeters in Oregon, plus help provide new wintering sites for Canadian trumpeters.



Sacked and ready to go. Four swans from Red Rock Lakes Refuge, Montana grab a quick snack before their first plane ride. The swans were transplanted to Malheur Refuge as part of the Trumpeter Swan project. RV 7/91

Earthwatch

Once again the refuge and the Malheur Field Station worked with the Earthwatch Student Expedition Program to host an archaeological field school for high school students. Seven students from New York, New Jersey, California, Louisiana, Ohio and Maine joined the refuge archaeologist and regional archaeologist, Anan Raymond, for two intense weeks of archaeology. The field school crew spent most of their time surveying the shoreline along the Harney Dunes Research Natural Area looking for archaeological sites. Once sites were found the students mapped the sites noting the location of features and filled out site forms with all relevant data.

The field school was not all work and no play. Students went on several field trips to see the surrounding area. Two day long field trips were made to see archaeological sites and geological phenomena. The students particularly enjoyed a trip to the top of Steens Mountain adjacent to the refuge. Many of them commented on the spectacular geology left behind

by the glaciers that once covered the mountain. Field school participants also got to try their hand at manufacturing stone tools and making a tule boat.



Earthwatch field school participants walk parallel transects along the shore of Harney Lake looking for archaeological sites. CB 7/91



One of many prehistoric fire hearths found by Earthwatch students during their survey. CB 7/91



The Earthwatch crew enjoys lunch while sitting on the edge of a glacially carved valley on Steens Mountain. CB 7/91



Earthwatch students gather tules to use in the construction of a tule boat similar to that used by the prehistoric inhabitants of Malheur Lake. CB 7/91

3. Items of Interest

Archaeological Program

The Archaeological Program expanded this year with the addition of a assistant archaeologist, Mike Reilly. Mike joined the staff in May, just in time for the beginning of the field season. Two archaeologists from the Student Conservation Association arrived in early June eager to begin work on Malheur Lake. A full-time volunteer, Chris Walsworth, participated (from June through August) in all aspects of the archaeological program.

Work continued on the flooded portions of Malheur, Mud and Harney Lakes. Once again a primary focus of the program was removal of human burials according to stipulations set forth in a Memorandum of Understanding between the Service, the Burns Paiute Tribe and the Oregon State Historical Preservation Office. Twelve burials and one cremation (found after it was looted) were removed to prevent further erosion and vandalism. These burials will undergo analyses by a physical anthropologist (See Section D5) prior to reburial in Spring 1992.

Surface artifacts were collected from several previously identified archaeological sites, as well as from new sites found during shore line surveys. Artifacts are collected to prevent their theft by collectors. Before collection the artifact locations are mapped using an electronic total station. The data collected during mapping are then used to generate maps detailing the exact location of the artifact. Associations of artifacts often become more apparent when seen on a map. Once artifacts are brought into the lab they are cleaned, described and assigned a permanent catalog number. Information gained from studying this material will be used for interpretive displays planned for the new interpretive center at headquarters (See Section D3).

As the water level continued to decline on Malheur Lake the threat of site vandalism continued to be a problem. A human cremation was dug up by vandals presumably in search grave goods. None of the burials recovered by archaeologists have yielded grave goods, so this grave, which was not planned for removal, was disturbed for no reason. To further compound the problem, cattle walked through the vandalized cremation causing more damage. Trampling of artifacts and burials by cattle was also a problem at other sites on the lakes. Increased vegetation enticed trespass cattle further out on the lake and on or near many archeological sites. To combat this problem the archaeological crew learned the fine art of constructing electric fences. As the water continued to recede around many sites electric fences grew in length.



Assistant Archaeologist, Mike Reilly, contemplates the inner workings of an electric fence and solar panel. DM 8/91



Refuge archaeologist Carla Burnside and SCA Joel Walker string electric fence ribbon near an archaeological site to protect it from trampling by trespass cattle. DM 8/91

The archaeological crew spent part of the summer locating all known rock art sites on the refuge. The exact location of these sites was established, photographs were taken and detailed site forms were completed for each site. This information provides baseline data which will be used to monitor natural deterioration of these delicate sites and to determine when vandalism has damaged the rock art.

Members of the Programmatic Review Team visited an archaeological site during their time at the refuge. An on-the-ground look at archaeological resources was the best way to understand the status of the program and to discuss plans for future work.



Members of the Programmatic Review Team travel by airboat to an archaeological site. DM 8/91



Programmatic Review Team and archaeologists huddle around an area containing artifacts. DM 8/91

The Regional Office Law Enforcement Division funded a cultural resource brochure, titled "Protecting the Past at Malheur National Wildlife Refuge", so the public could be better informed about the penalties of surface collection or digging at archaeological sites. (See Section L for this brochure)

4. Credits

Author Credits

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Rick Vetter

Dan Walsworth

B, F9, I5, I6

A, D4, D5, E1, E2, E7, J1, J3,
J4, editing, compilation,
assembly

C1, E1, E5, F11, editing

D2, E6, F1, F4, F5, F6, F7, F8,
F15

C4, D5, E7, F2, F15, G3, G4, G5,
G15, J1

D3, E2, E4, H1, H2, H5, H6, H7,
H8, H9

B, F10, G1, G2, G6, G7, G8, G10,
G11, G12, G16, G17

H17, I1, I2, I3, I4, I7

Photo Credits

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Larry McGowan
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Issue: The need for flexibility in funding to support physical fitness programs of field stations.

Solution: Rescind Deputy Director Smith's April 24, 1990 memo.

In 1991, for the first time ever, a physical was required of all refuge law enforcement officers. Additionally, fire crews are required to qualify with a step test score of 45 or better with the test administered intermittently throughout their appointment. This year this station spent over \$600.00 each for 5 law enforcement physicals given prior to taking the Physical Efficiency Battery. This heightened staff interest in fitness and raised the question of what the station could pay for in exercise equipment. In answer to the question I was sent the attached memos from Secretary Lujan and Deputy Director Smith.

It is not hard to see that Mr. Smith's answer to our question would be a firm "no". But requirements have changed since his April 24, 1990 memo was signed. His stated support of physical fitness is hardly a facilitative stance when followed by a qualifier that purchases of exercise equipment is not authorized. When we have a required Physical Efficiency Battery that includes a bench press and we spend hundreds of dollars on employee physicals it does not seem logical that we cannot spend \$200.00 on a weight set or related equipment. Physical fitness centers may be easily attainable in urban areas or in the Main Interior Building. However, if you are a refuge LE officer or firefighter required to live 50 miles from town that is not much consolation.

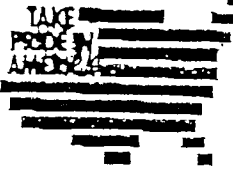
Please rescind the April 24 memo and allow project leaders discretion in the purchase of exercise equipment to support employee health and physical fitness requirements.



ADDRESS ONLY THE DIRECTOR.
FISH AND WILDLIFE SERVICE

United States Department of the Interior

FISH AND WILDLIFE SERVICE
WASHINGTON, D.C. 20240



In Reply Refer To:
FWS/CGS

APR 24 1990

Memorandum

To: Service Directorate
From: Deputy Director
Subject: Purchase of Exercise Equipment

The relatively recent emphasis on physical fitness has resulted in an increased interest in the purchase of exercise equipment by the Service. The Director and I support physical fitness for Fish and Wildlife Service employees in concert with the Secretary's policy (attached) and encourage employees to engage in personal physical fitness programs. However, in this time of limited resources, I consider it more important to allot all available funding to support our mission to conserve, protect, and enhance fish and wildlife and their habitats. Thus, the use of Service appropriated funds to pay the costs of exercise equipment is not authorized.

Attachment



THE SECRETARY OF THE INTERIOR
WASHINGTON

December 11, 1989

Memorandum

To: All Departmental Employees

From: The Secretary

A handwritten signature in dark ink, appearing to read "Samuel R. Gandy", is written over the word "Secretary" in the "From:" line.

Subject: Physical Fitness

The importance of exercise and physical fitness cannot be overstated. Engaging in a program of regular exercise reduces risk of disease, lowers health care costs and improves employee morale and productivity.

Recent interest in physical fitness both in the Federal and private sectors has made access to fitness centers easily attainable. However, exercise facilities such as the one in the Main Interior Building are not the only avenues of exercise. Many local recreation centers have excellent programs. Also, proven activities such as biking, walking or jogging require no facilities. This type of physical exercise can take place in a short period of time and is an excellent way of improving cardio-vascular capacity and overall health. I have recently begun a fitness program and encourage all Departmental employees to enter into a structured exercise program. For employees with health problems, it may be prudent to consult your private physician prior to participating in a fitness regime. It is never too late to start such a program and to do so will benefit not only yourselves but your families as well.

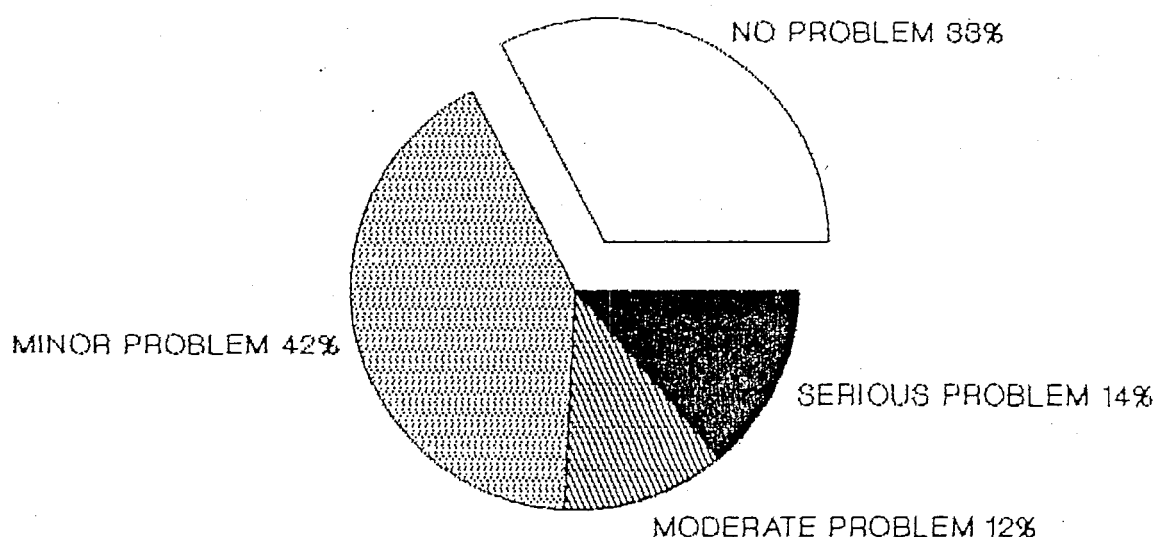
Issue: The need to design techniques for carp eradication to enhance waterfowl production

SOLUTION: Fund research to design effective carp eradication technology

Carp are an exotic, nuisance fish, imported from Eurasia. High carp populations are a detriment to waterfowl habitat. Their foraging, spawning and feeding habits increase water turbidity, and decrease macrophyte and invertebrate production, thus decreasing waterfowl food supplies. Carp's primary foods are aquatic invertebrates and they directly compete with waterfowl and many non-game waterbirds for those resources. Although the effects of carp are indirect, there is evidence that they have reduced duck populations by a factor similar to losses to diseases.

Carp are a significant problem in freshwater wetlands across North America. In 1981 the Malheur staff distributed a questionnaire to other refuges in the lower 48 states to determine the national scope of the carp problem. Of 162 field stations surveyed, only 54 (33%) indicated no carp problems. Nearly half of the stations

FIGURE V: CARP PROBLEM SURVEY - 1981
CARP PROBLEMS ON 68% OF REFUGES



reporting no problem were either upland or coastal refuges without freshwater impoundments, while over 80 percent of refuges with impoundments reported carp as a problem (Figure V).

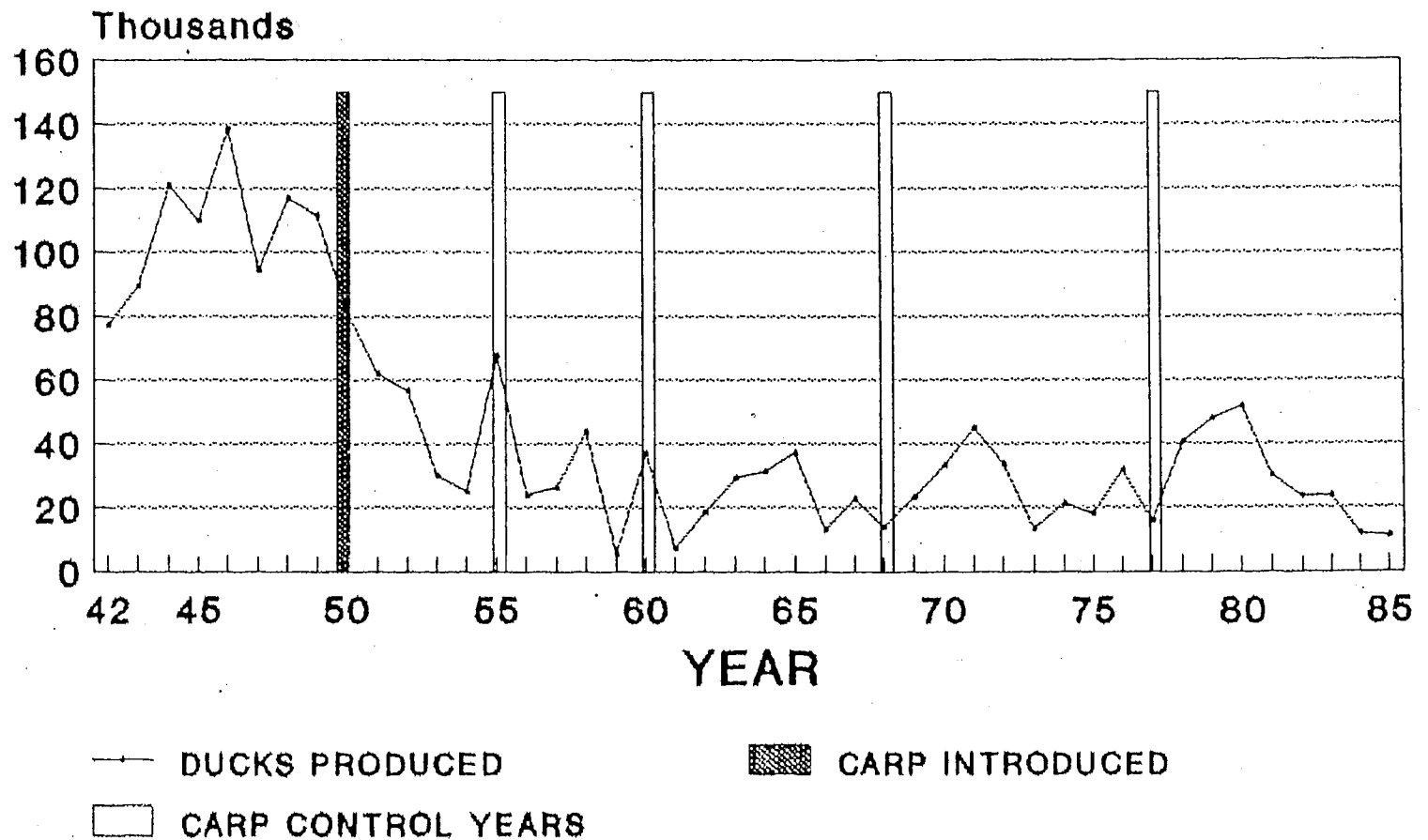
At Malheur, carp (Cyprinus carpio) have been recognized as a serious problem, limiting waterfowl production and use since their invasion into Malheur Lake in 1950. Before carp invaded the refuge, duck production averaged over 111,000 ducks produced annually in the 1940's, and peaked at 139,000 ducks produced in 1946 (Figure VI). During the years after the carp population became established, duck production has averaged less than 30,000 ducks annually. Spring and fall waterfowl use of the refuge has followed similar trends. Due to the presence of carp in Malheur waters, the refuge's potential for waterfowl production and maintenance has been lowered to 25% of its historic capability. The area could potentially produce in good wet years an additional 80,000 ducks a year, if carp could be eradicated.

What is needed to solve the carp problem is development of techniques to totally eliminate, where possible, carp from waterfowl production areas. We believe that technology is available to solve this problem. Biologically sound methods need to be developed. Research should consider methods such as bio-engineering (genetic manipulation), introduction of sterile hybrids or development and introduction of disease agents which could kill carp or interfere with breeding. Development of techniques targeted to only impact this fish species would be ideal.

Because Malheur Refuge is within a closed system, it would be an ideal area to design and test experimental carp eradication schemes. A successful project at Malheur could lead to greater benefits for waterfowl resources across the continent. We propose that the Service plan now to fund and implement research designed to find a solution to the carp problem.

It would be more prudent to enhance wetlands already managed by wildlife agencies by eliminating carp than to acquire additional wetland areas, especially in areas where intense public opposition to wetland acquisition exists, such as in the western states. Our proposal to explore carp control techniques is supported by the Oregon Department of Fish and Wildlife, the Pacific Flyway Study Committee, California Department of Fish & Game, Ducks Unlimited, Oregon Waterfowl & Wetlands Association, California Waterfowl Association and Oregon Trout. This project would make a good Joint Venture.

FIGURE VI: DUCK PRODUCTION
AT MALHEUR REFUGE



Proposed Public Service Development

Southeastern Oregon



Department of the Interior
U.S. Bureau of Land Management
U.S. Fish and Wildlife Service

A Synopsis of Proposed Public Service Development in Southeastern Oregon

The Setting

Southeastern Oregon is extraordinarily rich in beauty and natural and cultural resources. From wildflowers to wildlife, Native Americans to cattle barons, with textbook examples of geologic features throughout, this high desert environment is bountiful indeed. Intertwined both naturally and culturally are five natural gems: Malheur National Wildlife Refuge, Diamond Craters Recreation Area, Steens Mountain Recreation Area, Hart Mountain National Antelope Refuge and Warner Wetlands Recreation Area. All are managed by the federal government under the jurisdiction of either the Bureau of Land Management (BLM) or the Fish and Wildlife Service (FWS). These areas are linked by State Highways 205 and 140 off of U.S. Highway 395 between Burns and Lakeview, Oregon.

The Challenge

These five treasures, which are far removed from any city, are destination points for tens of thousands of visitors annually. More people are "discovering" the area, so visitation has been increasing dramatically. But natural and cultural resources information is not easily or readily available for the tourist. Recent flooding has damaged or destroyed many signs which did exist. Upon arriving at these places, the public finds little, if anything, to greet or guide them. Virtually nothing exists to tell people where they can camp or canoe, where to see sandhill cranes or the best time to look for alpine wildflowers. Basic facilities, such as restrooms, are lacking. Without facilities and information, newcomers may have a mediocre visit, never experiencing that spark which leads to a lifetime of curiosity and assures a return visit. The public may also leave with a negative image of the managing agency. Even repeat visitors probably have little understanding of each agency's role in protecting these national treasures. The challenges these agencies face is to provide basic facilities and services to the public.

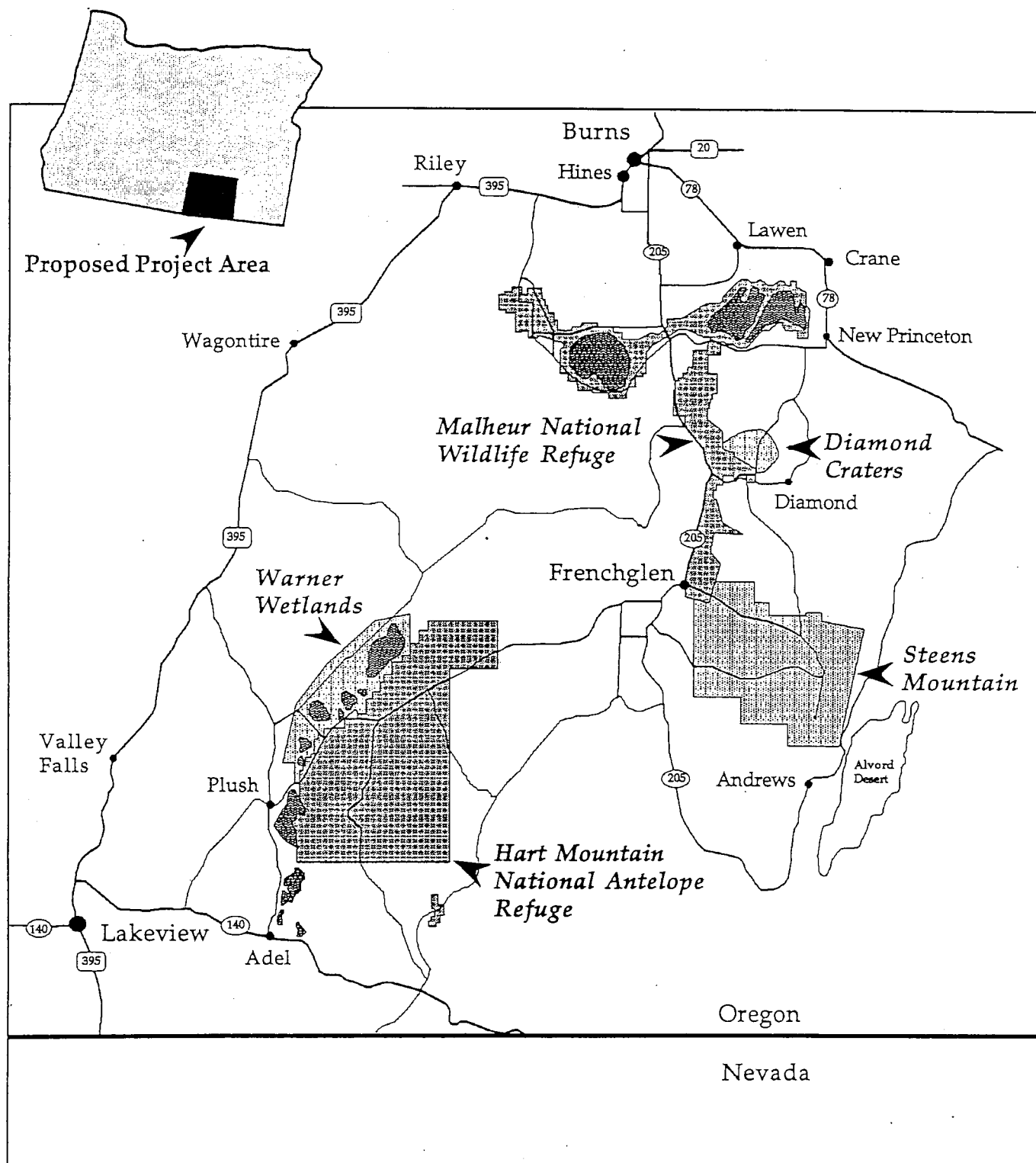
The Proposal

To meet these challenges, an interagency conceptual plan and designs are being developed to define needed directional signs, maps, educational exhibits and basic facilities, including restrooms, campgrounds, trails, and picnic areas. Developments would be modest but comprehensive and of low-maintenance design. They should not dominate over the landscape or the resources. The plan would be consistent with existing Recreation Area Management Plans for Diamond Craters, Steens Mountain and Warner Wetlands, and the plans for Malheur and Hart Mountain Refuges. The conceptual plan will define potential development costs and ongoing multiagency operations costs.

Two key orientation points will be established to welcome visitors to the area, guide and inform them of the resources, and tell them of the available recreational opportunities and optimum times for these activities. Restroom facilities would be provided at key visitation spots. In addition, three small visitor centers will be conceptually designed to tell the most important stories about the resources in the immediate area. Each center would have a different focus, enticing people to visit all three. Approximately 24 interpretive wayside areas will be developed to guide travelers to and tell them about the most exciting resources.

The Benefits to the Public...and the Agencies

Because these areas are naturally and culturally intertwined, visitors can experience not only a rich variety of resources, but their interrelatedness as well. The scope of this project provides the perfect opportunity for a unique partnership between the BLM and FWS. By working together, the agencies can conceive one plan encompassing all five areas that will provide a totally integrated experience for the public. Restroom facilities will be appropriately spaced and located throughout the project area. Instead of duplicating information from one place to another, one cooperative plan would weave the stories of these five places together. For example, reference to Warner Wetlands at a Malheur wayside exhibit would encourage the public to visit the Wetlands to further enhance their experience. By working together, two agencies can pool their expertise and resources to create a more vital, viable high-quality product that will provide a positive, meaningful visitor experience. When presented with an inclusive, integrated story of the area as a whole, visitors develop a much broader understanding and deeper appreciation of the resources. Furthermore, by working together to create such an enormous, unprecedented public use plan, two agencies demonstrate a powerful, unified commitment not only to management and conservation of the resources, but above all, to the public they serve.



Proposed Area of Public Service Development
Southeastern Oregon